ALGAL PRODUCTIVITY OF THE TROPICAL PACIFIC AS DETERMINED BY ISOTOPE TRACER TECHNIQUES

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(Terminal Report)

Algal Productivity of the Tropical Pacific as Determined by Isotope Tracer Techniques

UNIVERSITY OF HAWAII

Department of Botany

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The purposes of this contract having been achieved, the following material is presented as a terminal report. The original proposal by the University of Hawaii in March of 1953 was to undertake a program to develop and evaluate methods utilizing radioisotopes in the field for the determination of marine primary productivity. It was visualized that carbon-14 would be employed in the development and evaluation of the principal techniques and that these techniques would be extended to a) the determination of the variations and rates of organic productivity in the tropical Central Pacific, b) to a study of the effect of "island land masses" on marine productivity, c) to compare tropical and temperate oceanic productivity utilizing not only results obtained on this contract but the results obtained by others as well, and d) to make a comparison of the methods developed on this contract with the techniques others have developed for the same purposes. It was envisaged that significant information would be obtained concerning the mechanics as well as the ecology of marine algal productivity.

Progress toward the objectives of this contract was consistently made along a course which first involved tracer technique development as described in the different Annual Reports for 1954, '55, '56, '57, '58, '59, '60 and '61. The simple aspects of the carbon-14 method devised for relative productivity measurement have been reported to the scientific community in three principal publications (Angot, Doty & Oguri, 1958; Doty & Oguri, 1958; and Doty & Oguri, 1959; see also Doty [editor], 1963a).

The next phase was to use the carbon-14 technique in determining the general and some of the special features of algal productivity. In various of the Reports to this contract, this information was reported on an annual basis as gathered. All productivity data obtained by quantitative isotope techniques for the world's oceans were brought together in one publication (Doty & Capurro, 1961d) in which the results from this contract represented the largest part, though the results from this contract mostly concern just the Pacific Ocean.

Techniques for benthic algal productivity were developed also using quantitative tracer methods, and some preliminary information from Oahu was gathered. The general aspects of these isotope techniques utilizing sulfur-35, phosphorus-32 and calcium-45 as well as carbon-14 are reported upon in the Annual Reports for 1957, '60 and '61, but this work was dropped in order to complete the major work of the contract on marine phytoplankton productivity. The benthic work is being continued as a major part of the work being done on another contract.

Various analyses of the phytoplankton productivity data collected as a result of the application of the isotope technique developed have been made. The first of these was to obtain one of the stated objectives in the original proposal. i.e., to study what can be called the "land mass effect." This is, to put it another way, to find out how the productivity of the phytoplankton crop changes as one moves toward the beach through the region where the euphotic zone impinges upon the land and the bottom of the sea comes above the compensation point. It was found (Doty & Oguri, 1956) that as one approaches shore from the open ocean, phytoplankton productivity may increase 2 or perhaps 3 orders of magnitude. This same phenomenon (Doty, Soeriaatmadja & Soegiarto, 1963e) has been found elsewhere, and its presence has been affirmed by several others as well.

An analysis of data from the open ocean led to the discovery of a daily periodicity in the ability of the phytoplankton algae to carry on photosynthesis. This was found to be dependent upon the time of day that the measurement process was begun. The publishing of these results (Doty & Oguri, 1959) has led to a considerable bibliography from work continued on this phenomenon by others. The work on the present contract led to a discovery that this phenomenon extended to the benthic algae as well. The presence of such a periodicity has been denied and affirmed variously. Positive affirmation in repeated experiments (Buggeln, ms. in preparation) has now placed this phenomenon on a firm basis. One of the interesting extensions (Doty, 1959) is the discovery that this daily periodicity phenomenon varies with latitude. It is greatest in magnitude near the equator and decreases as it is measured at successively higher latitudes.

In the course of this work various other things were revealed such as geographic variability. Along the equator (King, Austin & Doty, 1957), the productivity is very high in relation to regions of upwelling. There is a rather sudden relative increase in productivity at, and higher north of, the junction between the subtropical and subarctic waters of the North Pacific (Guillard, Doty & Oguri, 1955). A general resume of the geographic variability of productivity (Doty, 1959g) was published as a result of a preliminary study of these relative productivity phenomena.

Primary productivity measurement was the topic for a series of symposia, entitled "Marine Productivity in the Pacific," held in conjunction with the 10th Pacific Science Congress in Honolulu at the University of Hawaii during the period of August 22 through September

9, 1961. This was planned as one of the final activities on this contract to review the subject of primary productivity measurement and as a terminal stock-taking activity. The papers have been published (Doty [editor], 1963a) with the inclusion of an extensive, yet selected, bibliography (Doty, 1963b) of the now large literature whereas, when the contract was begun, there were perhaps a dozen papers concerning empirical work in this field. In facilitating preparation for this symposium, several translations from the Russian were prepared and circulated as seemed appropriate among the participants. The major translation was the book by G. G. Vinberg (Doty [editor], 1963c), which is a major item in the literature of productivity. It concentrates on analysis and criticism of fresh water methodology from the Russian point of view. With the conclusion of the 10th Pacific Science Congress symposium and the distribution of the publications listed in the bibliography, below, it was felt that communication of the work of this contract to the scientific community was rather well completed insofar as technique development was concerned.

Acceptance of the technique developed has been almost universal with perhaps half of the workers using equipment devised on this contract as sold by various commercial suppliers or using a technique or equipment modified from that of this contract. Appendix III describes the following and other pieces of equipment not previously described in detail. The shipboard illuminated incubator developed is manufactured by the Gemware Manufacturing Company in New York City and the Rigosha Company in Tokyo. The Clarke Marine Hydrophotometer is a routinely used instrument for measuring irradiance with a flat plate collector as recommended by the SCOR primary productivity intercalibration working groups (at least up through 1963). As originally provided (see Annual

Report for 1955, Fig. 2), this instrument with any significant wire angle did not make the overboard readings from a horizontal flat surface. Furthermore, a simple control box to connect the desk and overboard cell has been a well felt need. The necessity for a non-toxic opaque sampler of large volume led to the adoption of one. This is in line with experimental evidence (see p. 18) that plankton from the depths must not be exposed to bright sunlight. To facilitate "in situ" incubation of the isotope inoculated samples, several pieces of equipment have been devised as described in Appendix III.

Until 1961 it had been impossible to complete certain technique studies because of the lack of ship time for biological purposes until time and facilities were provided aboard the U. S. Coast and Geodetic Survey vessel "Pioneer" and the U. S. Navy vessel "Rehoboth" during September through December 1961. On cruises of these two vessels, data were gathered for comparisons of incubation methods and for studies of the effects of sample time. The raw data from these cruises processed in part (Appendix I) are included in this report. (These results led to most of the experiments in Appendix II as efforts to clarify further points.) Publications on this and other information deriving from this contract can be expected to follow.

The principal investigator was invited to convene two primary productivity intercalibration sessions as working groups of the Special Committee on Oceanic Research in respect to the International Indian Ocean Expeditions. The first of these was held in Honolulu immediately following the close of the 10th Pacific Science Congress. The participants represented India, the Philippines, Indonesia, Russia, Japan, Australia, French Oceania and the U. S. A. with observers from other countries. The general conclusions from this study were published (Doty, 1962b) and this effort led to a second meeting of the working group. The second meeting was held at Cronulla, New South Wales, in Perth, Western Australia, and at sea aboard the vessel "Vityaz" of the Institute of Oceanology of the USSR.

Considerable strides were made toward standardization of techniques, less by the vigorous discussions and persuasion than through the joint and simultaneous use of the different methods and paraphernalia developed on the present contract by the different national groups involved in the intercalibration sessions. These groups were Australian, Japanese, Russian and American. The results could not be said to be truly those of the individual techniques for none of the participants was able to carry out his technique entirely as he would have on his own ship. However, it was most satisfying to learn that, even at a very low confidence level from a statistical point of view, the results (Doty, et al., mss.) obtained by the different groups were quite similar. The groups now look forward to being able to carry out parallel measurements with their respective techniques with sufficient replication to give a satisfactory degree of confidence in the relationships found between the techniques. If this can be done, then it would be possible by regression analysis to translate the results of one group into terms of another.

Finally, a technique manual has been begun to save supplying such information piecemeal in response to the several requests per year for directions. Needless to say, even in its present preliminary form, it is useful in training the ten or more technicians being used in Hawaii each year on this work financed on other contracts. This effort undertaken at the informal invitation of another Washington agency was hopefully combined with a NASCO effort on intercalibration and standardization which, after various meetings in which the principal investigator took part, has produced an outline of the biological oceanographic methods on which some degree of agreement could be obtained. Since this group is not producing a useful training manual, it is presumed the manual originally undertaken on this contract should be completed. This should involve modification to include the results of the work done during the terminal period on this contract and reported upon below.

Technique Studies During the Current Contract Period

The work rather nicely separates into development of quantitative tracer techniques for measuring the productivity of benthic algae on the one hand and of the phytoplankton on the other.

In respect to the benthic productivity work, a considerable amount of correspondence with others interested in this field, especially in the field of calcium metabolism in the coralline algae, has been carried out with, in addition, the interviewing of a number of individuals. The literature has been studied in this respect and a technique devised. Aside from obtaining special glassware so that work could be resumed as soon as funds for this purpose were available, the work was dropped insofar as contract AT-(04-3)-15 was concerned. The status of the work as completed on this contract is outlined in the proposal to AEC "AEC 2477," and it is with some pleasure that we can announce that work has resumed on this aspect of our productivity technique development studies on a different contract.

The quantitative tracer technique studies carried out during the present contract can be categorized as those concerning illumination, light shock, dark bottle fixation, bottle effects and respiration. Various data handling studies were completed as well. In part, these were taken up as a result of suggestions and criticisms offered by our colleagues. In part, these studies were in search of relationships between results from the relative productivity technique developed and "in situ" incubation results (the results of which are thought to be those most near the absolute results obtaining in nature) and also various natural and experimental phenomena observed from time to time. Appendices I and II present greater details concerning the points than it seems reasonable to include in this narrative portion of this report.

Cyclic variations in productivity potential have been a subject of particular concern and study. If one is concerned with producing a summary of productivity for a large area or long period of time adjustment, not only the differences between the techniques used, but at least three corrections for periodic variations in productivity may be necessary as well. These are at present thought to be related to daily periodicity, lunar periodicity and seasonal periodicity. It is known also, that at least some of these vary with latitude.

Daily periodicity is rather well established and is a subject taken up elsewhere in this report (Appendix II, pp. 58-74), and its changes with latitude (Doty, 1959) have been approached in a preliminary way.

In reference to daily periodicity, one of the carbon-14 fixation phenomena that is becoming realistic in our minds is that onshore and offshore plankton populations behave differently in bottles. Thus, our results are different depending upon which water type was used. It appears oxygen consumption (Laevastu, mss.) increases in offshore waters significantly with long incubation whereas it does not increase significantly in inshore waters. In inshore waters (Appendix II, Table XXXVI and Fig. 1), less radiocarbon is photosynthesized during morning half-days than during afternoon half-days. In offshore waters (Appendix II, Fig. 3; Doty & Oguri, 1957; Angot, 1961b, Fig. 1), the reverse is true with the morning production being as much as 2.4*/ times that in the afternoon.

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*/ Information from work on ONR contract Nonr 4108(00).

Two explanations for these differences found between inshore and offshore waters come to mind: a) The behavior on bottle walls of the predominantly Caulobacteriaceae of offshore waters in contrast to that of the predominantly planktonic bacteria of inshore waters; and b) the zenith sunlight intensity effects on photosynthesizers. The first concerns mostly the oxygen results, the latter the isotopic carbon results. Koblentz-Mishke (in lit.) has produced figures showing lessening of the mid-day depression with increasing latitude. Angot (1961b, Fig. 7) illustrates the difference between the effect in surface waters, such as Doty & Oguri (1957) used, and the effect in water from the depths. The Doty & Oguri results were obtained near the equator where the noon day depression is greatest. Perhaps if the sun's zenith brightness is great enough, the phytoplankton do not recover in time to produce the afternoon maximum observed in results from inshore waters. This idea is borne out by Angot's results (1961b, Fig. 7) with water from the surface and from the 50-meter level. In further support of this hypothesis, note the lower afternoon peak or its lack in the results (Appendix II, Fig. 1) from the 2-hour sunlight incubations as opposed to the strong afternoon peak fluorescent-lit and long term sun-lit incubator results for the same times.

Searching for support of this idea in open ocean results from comparable radiocarbon technique applications is one of the future lines of study. The relatively high latitude results available (Table IV, pre-08:00 vs. post-11:00 classes) lead us to feel that equatorial intensities alone are not responsible for the larger morning values reported from the open sea.

Earlier work (Annual Report, 1958, pp. 54-57, Fig. 11), with samples held and incubated at a standard time to correct for daily periodicity, was repeated on the "Pioneer" cruise in 1961. The results (Table I) are consistent with those from experiments in Indonesia and South China Sea waters in showing an increase in productivity rates. There was, however, no apparent useful consistency in the results.

Our current thinking on the problem of making this correction for periodicity is outlined on page 23.

Lunar periodicity, being suspected from various lines of evidence, led to a preliminary experiment (Appendix II, Expt. 2, pp. 4ff. and 75ff.) carried out to estimate the likelihood of the presence or absence of such a phenomenon.

Seasonal periodicity in phytoplankton productivity is well known in higher latitudes from the work of Steemann-Nielsen (1958) and Ryther & Yentsch (1958). In our work, little seasonality has been found near Oahu, the chance occurrence of storms, etc., seemingly being of much greater magnitude in their influence on productivity. (On another project the seasonal variations in productivity at even lower latitudes

TABLE I. Mean productivity values of the replicates in mg C/hr/m^3 from incubations of water placed in standard sets of bottles and incubated at the times indicated on the "Pioneer" cruise (NO66). "Standard time" was about 09:00. The sample time and standard time incubations were done in the 1961-type incubators using fluorescent light; the 24-hour incubations were done in the 1961-type incubator bottoms using sunlight.

Station & Latitude		Sample time	General "time in" hourly rate		
			Sample time	Delayed until standard time	24-hour
330	32°22'	20:00	.030	.069	.063
435	39°30'	16:00	.136	.103	.036
570	45°48'	18:35	.607	.744	.204
1092	51°16'	17:30	.638	.662	.246
1156	53°13'	17:34	1.763	2.548	.815
1411	41°34'	18:10	.065	.266	.210
1467	39°22'	20:15	.032	.311	.122
1513	36°59'	18:15	.027	.089	.051
1553	34°46'	18:06	.064	.088	.046
1595	32°44'	18:05	.040	.124	.021
1642	28°48'	18:15	.065	.011	.039
1679	26°34'	18:00	.013	.098	.046

in the open ocean are being investigated currently on a series of monthly cruises for a 16 month period.)

It is shown clearly in our work (Appendix II) that the incubator used is less influential in the results than the time of day the measurement is made and we infer from other studies (Doty, et al., mss.) that the differences caused by differences between the over all technique of the Australians, Japanese, Russians and Americans are also less than the variations in productivity due to time of day the measurements are made. Both incubator and general method would seem to introduce less variation away from the equator than is due to seasonal differences and also as due to the possible lunar periodicity. The lunar periodicity being about a 2-fold difference and the technique error being about 20 to 30%. The differences in results due to incubator type (i.e., commonly used types) is also of about the same magnitude as that due to technique and sample error. This latter is revealed in Tables II and III which present results from the types of incubation used on cruises (Appendix I, Fig. 1) of the USC&GS vessel "Pioneer" (cruise NO66) and the U. S. Navy Hydrographic Office vessel "Rehoboth" during 1961.

The techniques and raw data from the "Pioneer" and the "Rehoboth" cruises are described and the raw data presented as Appendix I.

A statistical comparison between the results from the different techniques used on cruise NO66 is shown, by sample time, in Table IV. Except as a relative measure, there is no value to group means ($\bar{x}$) or coefficient of variation (C%) between groups. However, as points in comparing the different technique groups and times of day the following are suggested. That the coefficients of variation found are actually lower in the pre-08:00 classes indicates, perhaps, that the technique

TABLE II. Comparisons of the data obtained from four different incubation techniques during cruise N066 (Notebook 66 and data library). The samples were from different latitudes and at each station they were taken from five light per cent depths. The values given are the integrated values for each station and are given in milligrams of carbon converted from the inorganic to the organic state per hour per square meter of ocean surface. The incubators were the 1961-type with the fluorescent lights in operation for the "electric light" cases and with the fluorescent light bank removed and the bottles exposed to the open sunlight in the cases of the "sunlight" examples. The filters were black nylon net passing approximately 64, 30, 16 and 1 per cent of the light. The surface samples were enclosed in no filters in any case. In each case the 1961-type electrically lit incubator result obtained with filters is used as a standard.

Station number	Time in	Technique used			
		Electric & filters	Electric no filters	Sunlight & filters	Sunlight no filters
67	13	.489	6.448		
91	06	1.991	12.784		
102	13	.791		1.048	
143	08	1.336		5.925	
148	12	1.054			3.713
191	08	2.795			2.239
194	14	.707	1.526		
229	07	.575	3.008		
316	13	.303		1.288	
349	07	1.211			7.073
363	13	.600			5.338
397	07	.757		3.087	
481	13	4.440	21.289		
515	07	6.304	25.098		
567	14	9.381		14.208	
589	07	4.300		12.194	
604	13	4.932			12.454

Station number	Time in	Technique used			
		Electric & filters	Electric no filters	Sunlight & filters	Sunlight no filters
640	07	27.892			53.037
646	14	10.806	18.434		
1092	11	2.868		2.789	
1131	07	4.868		8.532	
1145	12	17.498			36.164
1186	06	42.278			67.751
1201	12	26.767	90.111		
1240	07	6.410	26.786		
1245	14	5.107		1.540	
1275	08	8.669		7.365	
1368	13	2.375			14.514
1389	06	9.804			23.268
1402	12	1.834	13.630		
1435	06	.886	6.170		
1450	12	.449		2.017	
1489	06	1.493		4.792	
1502	12	1.317			3.670
1530	06	.523			4.690
1576	06	1.511	8.003		
1590	13	.768	7.562		
1618	06	1.833	8.052		
1626	12	1.712		5.693	
1655	07	2.047		5.657	
1670	13	1.256			36.385
1704	06	11.758			8.319

TABLE III. Comparisons of the data obtained from two different incubation techniques during the cruise N067 (Notebook 67 and data library). The samples were from different latitudes and are given in milligrams of carbon converted from the inorganic to the organic state per hour per square meter of ocean surface. The incubators were the 1961-type and the filters were black nylon net passing approximately 64, 30, 16 and 1 per cent of the light.

Station number	Time in	Technique used	
		Samples from the light depths	Neutral density filters-simulated depths
01	08	2.643	4.076
	13	.610	.873
02	07	1.063	1.409
	13	.775	2.362
03	07	2.362	1.833
	13	1.597	2.355
04	07	1.444	1.737
	13	1.493	.388
05	07		
	13	.201	.503
06	12	.522	.284
07	08	14.730	13.631
	13	2.649	4.728
08	08	8.316	6.114
	14	2.126	2.036
09	08	3.534	3.741
	14	.115	4.021
10	07	1.842	.944
	12	.178	.178*/

*/ All but surface were negative.

Station number	Time in	Technique used: Samples from the light depths	Technique used: Neutral density filters-simulated depths
11	07	1.186	1.382
	13	1.367	1.203
14	12	.958	1.794
15	07	6.748	1.415
	13	.331	.544
16	08	6.051	8.574
	12	.451	.412
17	07	4.656	4.514
	13	.456	.657
18	07	10.506	8.782
	13	1.220	2.715
19	06	4.373	4.535
	13	2.014	1.813
20	08	4.530	5.720
	13	99.531	.883
21	08	1.547	1.781
	13	.383	.598
22	08	1.942	3.438
23	08	2.828	
24	14	1.375	
25	08	2.462	
	14	.627	

TABLE IV. Statistical comparisons of data from N066 (Table II).

		Electric w/ filters	Electric w/o filters	$\bar{x}$ ratio	Electric w/ filters	Sunlight w/filters	$\bar{x}$ ratio	Electric w/filters	Sunlight w/o filters	$\bar{x}$ ratio
Measurement initiated at or before 08:00	$\bar{x}$	2.787	12.843	5.21	3.353	6.793	2.85	13.752	23.768	3.17
	C%	89	73	22	84	43	44	114	110	97
	r	——— .99	——		——— .55	———		—— .97	———	
		———	——— -.69	——	———	——— -.91	——	———	——— -.48	——
			—— -.59	——		—— -.44	——		—— -.35	——
Measurement initiated at or after 11:00	$\bar{x}$	6.544	22.714	6.07	2.944	4.083	2.31	4.147	16.034	7.84
	C%	147	135	71	112	116	73	146	90	123
	r	——— .96	——		—— .82	——		—— .61	——	
		———	——— -.48	——	———	——— -.57	——	———	——— -.33	——
			—— -.34	——		—— -.14	——		—— .53	——

is less sensitive at that time of day. Perhaps the higher coefficients of variation in the post-11:00 class indicates variation, in addition to the geographic variation, induced by variation in sun from day to day; as it has been shown in other experiments that the brightness of the sun (Appendix II, pp. 68f.) is an influential factor during the middle of the day. The consistently lower variability, by the same measure, in the ratios between the standard technique and the experimental techniques (classes A, B & C) in the pre-08:00 class as over the post-11:00 class may in part be due to a change in sensitivity of the populations with latitude...note in this connection that in all 6 code groups the values are arranged as obtained from south to north.

The variation of sunlight intensity has been suggested above to be an influential factor contributing to variability of results. Intensity itself has also been considered to have a role in the suppression of carbon-14 fixation activity in water samples which have been subjected to greatly increased light intensities when brought from the sea into the air aboard ship. This phenomenon is referred to as light shock.

Light shock becomes a significant factor for it is apt to be a feature of the "in situ" technique, which technique has been accepted rather widely as being the best for an international reference technique. This is because, in fastening the bottles to the line that will suspend them in the sea, the bottles are often exposed to the sun or bright light on the deck of the ship for a few minutes.

As a result of conferences held aboard the "Vityaz" and in Cronulla (near Sydney, Australia) in connection with the last in the series of SCOR-UNESCO intercalibration sessions for IIOE primary productivity methods, experiments were carried out in Hawaii to determine the reality and nature of the light shock phenomenon which most productivity workers were rather sure was present. These were done in such ways that the time of incubation, temperature and other controllable conditions were uniform.

In one particular experiment, water samples were obtained in opaque samplers and all bottles were filled at the same time in the dim light of a below-decks laboratory. The light shock was administered by bringing the experimental bottles into the sunlight at such times that sunlight exposure was terminated simultaneously for all of them. All bottles, including the controls that had been kept in the dim light of the laboratory, were then inoculated and incubated in the 1958-type incubators (Appendix III) illuminated with fluorescent light. Doty & Oguri (1958) describe the carbon-14 technique and the incubators used. The surface samples were uniformly exposed to about 1500 foot candles of light while incubating, those from the 32 per cent light depth to about 48 foot candles and the 1 per light depth samples to about 15 foot candles. These relative intensities were obtained by using calibrated black nylon netting sleeves around each of the 32 and 1 per cent light level bottles. The incubations were simultaneous and of nearly uniform duration. Figure 1 illustrates the results from one experiment repeated three times. The other somewhat different experiments gave similar results, all of them indicating a strong depressing effect from even a few minutes exposure of the plankton samples to bright sunlight.

The inference is clear that samples must be kept out of the bright sun. The use of opaque samplers, such as described in Appendix III, is recommended as is the handling of samples inside a laboratory out of the sun. Special precautions should be taken in initiating "in situ" experiments to avoid light shock as the string of bottles is assembled and put in the sea. There was frequently a stimulation (Figure 1) from the one and four minute sunlight exposures. It must be kept in mind that both experimental and control subsamples were in the dim light of the shipboard laboratory when inoculated with the carbon-14 solution. Quite obviously, this stimulus would make an interesting side line for investigation.

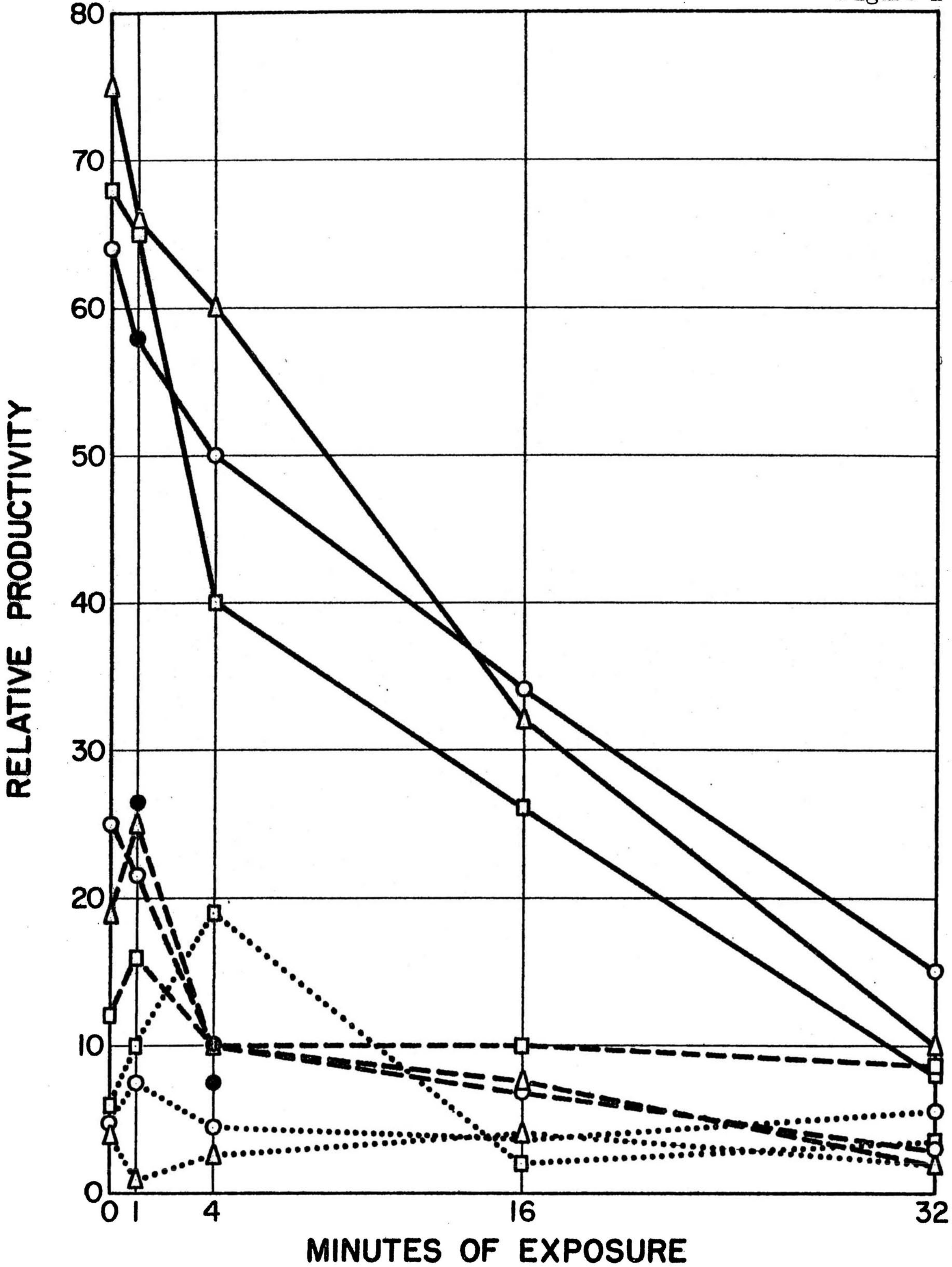
Another line of investigation (Appendix II, pp. 87-90 & Fig. 9), was into sources of light for inducing radio-carbon uptake by photosynthesis. It was soon found that only in exceptional cases does sunlight at any intensity induce carbon-14 fixation at rates as high as the 1500 f.c. or higher intensity from "cool white" Westinghouse fluorescent tubes used in the 1958-type incubators described in Appendix III. This points to a fraction of the sunlight which, with neutral density filters being used, varies proportionately to the photosynthesis-stimulating wave lengths and reduces their effect when compared to the fluorescent light used. Under the experimental conditions used, red light added was accompanied by increases in isotopic carbon uptake. Other experiments support results of Vollenweider (unpublished) that ultra-violet is the inhibiting fraction in sunlight.

The obvious asymmetries in the periodic changes in carbon-14 productivity measurements and the noon time depression reflected upon above as a function of time of day led us (Doty, Soeriaatmadja & Soegiarto, 1963) to use regression methods in smoothing data for horizontal distributional studies. This has been combined in our effort to devise a practical plankton, or biological, shipboard program. The heart of this program is the radioisotopic method of measuring the rate food is

Figure 1. <u>The effect of sunlight on the ability of phytoplankton to photosynthesize as determined in separate experiments on three successive days</u>. The exposure to direct sunlight was made on the ship's deck without the temperature in the bottles being allowed to rise more than about one degree Celsius. The length of such exposure to sunlight is indicated on the abscissa in minutes. Each point represents the mean of two light bottle values with the exception of the two cases where they are shown as solid points, in which cases, only the higher of the two values was used. Each of the lower values is shown as an isolated point. The following coding identifies the data used as well as providing the date of the experiment and the approximate sunlight intensity to which the experimental samples were exposed:

Source of Plankton		Date & surface light intensity in foot candles	
——	Surface meter of water	○ = 2-X-'63	13,110
------	Depth at which 32% of surface light remains	△ = 3-X-'63	11,250
......	Depth at which 1% of surface light remains	□ = 4-X-'63	7,500

Figure 1


RELATIVE PRODUCTIVITY
80
70
60
50
40
30
20
10
0
0
1
4
16
32
MINUTES OF EXPOSURE

combined from free energy and inorganic materials at sea. Since ship time is usually at a premium for biological work, a minimum has been planned. This minimum is at present stated as one stop per day at a standard sun time and permission for underway sampling at two to three hour intervals. The standard time stop is to provide a base for adjusting the underway values by regression methods and offset the periodicity phenomena. The stop requires 15 to 60 minutes depending largely on the winch operations possible aboard the ship. The types of data gathered are indicated by the Tables in Appendix I, if only one technician is aboard. With two technicians, not only is sampling extended over the 24-hour period, but it includes other data as well, e.g., bathythermograph casts and seston samples.

The current application of the isotopic carbon-14 technique to oceanic cruises obviously has required attention be given the merits of selecting one time over another for the standard sun-time station. Some of the criteria for selecting the time have become clear. From carbon-14 experiments reported in Appendix II, pp. 73f., it is clear that a time of day when short term incubations or 24-hour incubations yield hourly rates which, when multiplied by day length in hours, provide daily values that are near the most reliable estimates of daily productivity can be determined. Actually, there seem to be two such times of day, shortly after sun-up in the morning and shortly before sun-down in the evening. While it would make less difference if artificial light incubators were to be used, we have concentrated on the morning period for three reasons. These are a) the most careful attention to sampling detail can be obtained by the marine technicians and ship's crew first thing in the morning, b) use of sunlight incubators is rendered more possible, and c) seas are more apt to be at a minimum. There is little differences in reference to subsurface light measurement, both times are almost equally bad.

The only objective evidence favorable to selection of a mid-day time for standard stations for a program centered on carbon-14 measurements of productivity is that light is easier to measure at the per cent depths, for near noon the 100 per cent value is higher. In our opinion, the early morning time might not be best if one could make many measurements each or if the productivity during the day were symmetrical and there was no noon day or surface depression phenomenon.

Currently, the standard "time in" for incubation of productivity samples being processed by the radioisotope method is suggested as near one hour after sunrise. This time is accepted as a result of considering the points discussed above and the experimental results detailed in pp. 58-74 of Appendix II.

As a result of this study, other phenomena have been brought to light and are, thus, available for further study as incidental products of this work, such as the following reported on in more detail in Appendix II:

a) Evidence of the relative significance of physiology and biomass as causative factors in the daily periodicity phenomena observed (pp. 58-74 & 76).

b) Evidence for non-diurnal cycles in productivity that may be lunar (p. 75).

c) Evidence for respirational periodicity (p. 78) and the generalized mineralization (or respiration) rate (p. 79) in 26 measurements having (Table XLII, p. 80) a mode, mean and median of 15% of the productivity.

d) Evidence that dark bottle phenomena (p. 81f.) are not unusually sensitive to technique, contamination or light leaks.

e) Evidence that there is a rapid initial dark isotope uptake followed by lower rates (p. 82) in both planktonic and benthic algae.

f) Evidence for dark bottle periodicity (p. 85) seems clear though small on an absolute scale. The maximum in dark carbon-14 uptake rate is near 20:00, the time of minimum productivity, and the minimum in dark uptake rate is in the early daylight hours.

g) Evidence dark uptake is more likely due to chemical exchange or physical adsorption (p. 86) rather than due to streptomycin sensitive biological activity.

h) Evidence of the nature of the surface and noon-time depressions (pp. 87-90) so often reported in the productivity literature.

i) Evidence that HCl stronger than 1 normal including its fumes for 10 minutes may result in seriously lowered productivity measurements. HCl washes with HCl between .001 and 1.0 normal yield results which are higher than mere sea water rinses with no great difference between these concentrations being shown (pp. 49-56 & 91). HCl fumes for $\frac{1}{2}$ or 1 minute yield results significantly higher than any other treatment.

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APPENDIX I
(1964)

Raw Data from September-October Cruise N066

and November-December Cruise N067

As gathered by the Botany Department

of the University of Hawaii

Work done under contract AT-(04-3)-15 with the U. S. Atomic Energy Commission

During the latter part of 1961, we were provided with an opportunity to gather information on the ways primary productivity varies with the standing crop of zooplankton, phytoplankton, light and the hydrography of areas to the north and south of Hawaii. In addition and most important, miscellaneous incubation technique comparisons were carried out.

These investigations were made in conjunction with two separate cruises. The cruise plan for each is shown as a track on Figure 1.

The first of these was aboard the U. S. C. & G. S. vessel "Pioneer", on cruise Project OPR 421, Phase II. The primary productivity work of this cruise, which left Honolulu on September 7, 1961 and returned on October 12th, was conducted by Mr. Roy Tsuda and Mr. Neil Shim of the Botany Dept., University of Hawaii. Results are given in Table I.

Throughout, incubation was in the 1961-type incubators. These are composed of 2 parts, a bank of 8 "cool white" Westinghouse 20-watt fluorescent tubes over a tank of water. The tank of water was at sea surface temperature and the water was just deep enough to cover the 250 ml sample bottles used as these lay on their sides.

The incubator tanks were used for all light bottle incubations on both cruises. In some cases, the fluorescent light source described above was used and in other cases, sunlight was used.

The four productivity techniques employed are briefly described below, together with the code number which identifies them on the data tables for NO66.

1. Water samples from the surface meter and from the per cent light

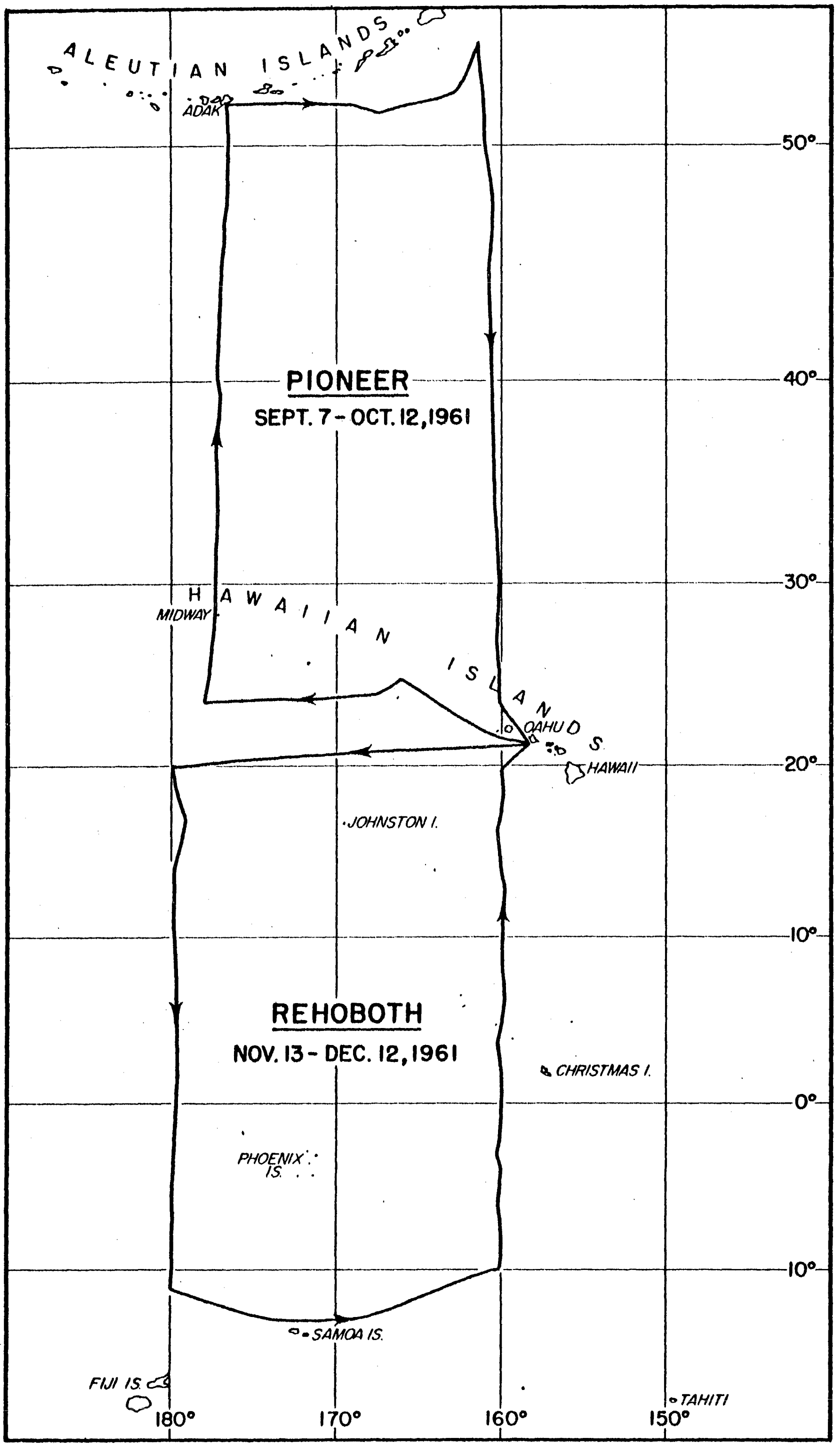

Figure 1. Tracks made by the two cruises with which this appendix is concerned and which involved the U. S. C. & G. S. ship "Pioneer", NO66, and the U. S. S. "Rehoboth", NO67.

depths of 64, 30, 16 and 1 as determined the previous noon. The samples were held in the 1961-type fluorescent incubator, described above, with neutral density filters for the respective depths. These samples were taken within one hour after daylight or within one hour of local apparent noon.

2. As technique #1 but without neutral density filters.

3. As technique #1 with the filters, but with incubation in natural ambient sunlight.

4. As technique #1 but with incubation in natural ambient sunlight and without neutral density filters.

The symbols used for identification of the card 5 data which follow are shown below.

VE - The vessel or area identification number or notebook reference.

CR - The cruise or notebook number.

STA - Station number.

NUM - The light bottle planchet number.

H - Local zone time of the hour when the sample was collected. Arrived at by dropping the minutes as e.g., 9:32 PM becomes "21".

DMY - Day, month and year.

LAT - Latitude with seconds rounded off to the nearest minute.

LONG - Longitude with seconds rounded off to the nearest minute.

MS - Marsden statistical rectangle.

DPTH - Depth of sample in meters.

1 - Field technique used. Asterisk indicates negative value.

PROD - Productivity in terms of mg C/hr./m^3.

CHL A - Chlorophyll _a_

CHL B - Chlorophyll _b_

CHL C - Chlorophyll _c_

TOTAL - Total chlorophyll

NAS - Non-astacine carotinoids

AS - Astacine carotinoids

These pigments are in terms believed to be the equivalent of milligrams per cubic meter.

TABLE I. Productivity and pigment data, Pioneer, 1961 (N066).

VE	CR	STA	NUM	H	D	M	Y	LAT	LONG	MS	DPTH	1	2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR	
NO	66	0067	7003	13	09/09/61			2442N	16621W	089	0001	2		5	000.054	00.12	00.08	00.89	01.09	0.07-	0.12			N066	5
			7003								0001	1		5	000.054	00.12	00.08	00.89	01.09	0.07-	0.12				5
			7004								0001	2		5	000.040	00.12	00.08	00.89	01.09	0.07-	0.12				5
			7004								0001	1		5	000.040	00.12	00.08	00.89	01.09	0.07-	0.12				5
			7006								0004	1*		5	000.008-	00.12	00.05	01.12	01.29	0.07-	0.12				5
			7007								0004	1*		5	000.022-	00.12	00.05	01.12	01.29	0.07-	0.12				5
			7009								0004	2		5	000.051	00.12	00.05	01.12	01.29	0.07-	0.12				5
			7010								0004	2		5	000.061	00.12	00.05	01.12	01.29	0.07-	0.12				5
			7011								0018	1		5	000.009	00.01	00.00	00.01-	00.00	0.00	0.00				5
			7012								0018	1		5	000.014	00.01	00.00	00.01-	00.00	0.00	0.00				5
			7014								0018	2		5	000.081	00.01	00.00	00.01-	00.00	0.00	0.00				5
			7015								0018	2		5	000.042	00.01	00.00	00.01-	00.00	0.00	0.00				5
			7016								0039	1		5	000.002	00.00	00.00	00.18	00.18	0.05-	0.08				5
			7017								0039	1*		5	000.003-	00.00	00.00	00.18	00.18	0.05-	0.08				5
			7019								0039	2		5	000.056	00.00	00.00	00.18	00.18	0.05-	0.08				5
			7020								0039	2		5	000.085	00.00	00.00	00.18	00.18	0.05-	0.08				5
			7021	14							0084	1		5	000.003	00.00	00.00	00.00	00.00	0.02-	0.02				5
			7022								0084	1		5	000.002	00.00	00.00	00.00	00.00	0.02-	0.02				5
			7024								0084	2		5	000.053	00.00	00.00	00.00	00.00	0.02-	0.02				5
			7025								0084	2		5	000.056	00.00	00.00	00.00	00.00	0.02-	0.02				5
		0091	7026	06	10/09/61			2356N	16722W		0001	2		5	000.041	00.05	00.03-	00.28	00.30	0.03-	0.05				5
			7026								0001	1		5	000.041	00.05	00.03-	00.28	00.30	0.03-	0.05				5
			7027								0001	2		5	000.077	00.05	00.03-	00.28	00.30	0.03-	0.05				5
			7027								0001	1		5	000.077	00.05	00.03-	00.28	00.30	0.03-	0.05				5
			7029								0004	1		5	000.105	00.04	00.02-	00.22	00.24	0.04-	0.07				5
			7030								0004	1		5	000.089	00.04	00.02-	00.22	00.24	0.04-	0.07				5
			7032								0004	2		5	000.223	00.04	00.02-	00.22	00.24	0.04-	0.07				5
			7033								0004	2		5	000.182	00.04	00.02-	00.22	00.24	0.04-	0.07				5
			7034								0018	1		5	000.032	00.02	00.03-	00.64	00.63	0.06-	0.07				5
			7035								0018	1		5	000.041	00.02	00.03-	00.64	00.63	0.06-	0.07				5
			7036								0018	2		5	000.124	00.02	00.03-	00.64	00.63	0.06-	0.07				5
			7037								0018	2		5	000.158	00.02	00.03-	00.64	00.63	0.06-	0.07				5
			7038								0037	1		5	000.016	00.01	00.01	00.05	00.07	0.07-	0.07				5
			7039								0037	1		5	000.005	00.01	00.01	00.05	00.07	0.07-	0.07				5
			7041								0037	2		5	000.109	00.01	00.01	00.05	00.07	0.07-	0.07				5
			7042								0037	2		5	000.168	00.01	00.01	00.05	00.07	0.07-	0.07				5
			7043								0084	1*		5	000.004-	00.11	00.02	00.20	00.33	0.03-	0.06				5
			7044								0084	1		5	000.002	00.11	00.02	00.20	00.33	0.03-	0.06				5
			7046								0084	2		5	000.095	00.11	00.02	00.20	00.33	0.03-	0.06				5
			7047								0084	2		5	000.076	00.11	00.02	00.20	00.33	0.03-	0.06				5
		0102	7054	13				2357N	16733W		0001	1		5	000.013	00.10	00.01	00.76	00.88	0.07-	0.14				5
			7055								0001	1		5	000.003	00.10	00.01	00.76	00.88	0.07-	0.14				5
			7057								0001	3		5	000.001	00.10	00.01	00.76	00.88	0.07-	0.14				5
			7058								0001	3		5	000.006	00.10	00.01	00.76	00.88	0.07-	0.14				5
			7060								0004	1		5	000.024	00.10	00.02	00.98	01.10	0.08-	0.17				5
			7061								0004	1		5	000.027	00.10	00.02	00.98	01.10	0.08-	0.17				5
			7063								0004	3		5	000.027	00.10	00.02	00.98	01.10	0.08-	0.17				5
			7064								0004	3		5	000.032	00.10	00.02	00.98	01.10	0.08-	0.17				5
			7066								0029	1		5	000.019	00.04	00.02	00.31	00.36	0.05-	0.06				5
			7067								0029	1		5	000.004	00.04	00.02	00.31	00.36	0.05-	0.06				5
			7069								0029	3		5	000.010	00.04	00.02	00.31	00.36	0.05-	0.06				5

VE	CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1	2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR
NO	66	0102	7070	13	10/09/61	2357N	16733W	089	0029	3		5	000.017	00.04	00.02	00.31	00.36	0.05-	0.06			NO66 5
			7072	14					0059	1		5	000.000	00.10	00.08	00.62	00.80	0.09-	0.13			5
			7073						0059	1		5	000.004	00.10	00.08	00.62	00.80	0.09-	0.13			5
			7075						0059	3		5	000.010	00.10	00.08	00.62	00.80	0.09-	0.13			5
			7076						0059	3		5	000.006	00.10	00.08	00.62	00.80	0.09-	0.13			5
			7078						0086	1*		5	000.002-	00.07	00.06	00.25	00.38	0.06-	0.07			5
			7079						0086	1*		5	000.001-	00.07	00.06	00.25	00.38	0.06-	0.07			5
			7081						0086	3*		5	000.003-	00.07	00.06	00.25	00.38	0.06-	0.07			5
			7082						0086	3*		5	000.001-	00.07	00.06	00.25	00.38	0.06-	0.07			5
		0143	7093	08	11/09/61	2329N	17224W	090	0000	1		5	000.076	00.02	00.03	00.32	00.38	0.08-	0.09			5
			7094						0000	1		5	000.087	00.02	00.03	00.32	00.38	0.08-	0.09			5
			7096						0000	3		5	000.028	00.02	00.03	00.32	00.38	0.08-	0.09			5
			7097						0000	3		5	000.026	00.02	00.03	00.32	00.38	0.08-	0.09			5
			7099						0004	1		5	000.055	00.05	00.07	00.27	00.39	0.06-	0.07			5
			7100						0004	1		5	000.050	00.05	00.07	00.27	00.39	0.06-	0.07			5
			7102						0004	3		5	000.098	00.05	00.07	00.27	00.39	0.06-	0.07			5
			7103						0004	3		5	000.111	00.05	00.07	00.27	00.39	0.06-	0.07			5
			7105	09					0029	1		5	000.012	00.06	00.04	00.28	00.38	0.05-	0.08			5
			7106						0029	1		5	000.010	00.06	00.04	00.28	00.38	0.05-	0.08			5
			7108						0029	3		5	000.096	00.06	00.04	00.28	00.38	0.05-	0.08			5
			7109						0029	3		5	000.102	00.06	00.04	00.28	00.38	0.05-	0.08			5
			7111						0059	1*		5	000.001-	00.06	00.06	00.35	00.47	0.07-	0.10			5
			7112						0059	1*		5	000.008-	00.06	00.06	00.35	00.47	0.07-	0.10			5
			7114						0059	3		5	000.039	00.06	00.06	00.35	00.47	0.07-	0.10			5
			7115						0059	3		5	000.051	00.06	00.06	00.35	00.47	0.07-	0.10			5
			7117						0086	1		5	000.005	00.05	00.02-	00.29	00.33	0.07-	0.09			5
			7118						0086	1		5	000.001	00.05	00.02-	00.29	00.33	0.07-	0.09			5
			7120						0086	3		5	000.011	00.05	00.02-	00.29	00.33	0.07-	0.09			5
			7121						0086	3		5	000.015	00.05	00.02-	00.29	00.33	0.07-	0.09			5
		0148	7123	12			17226W		0000	1		5	000.029	00.05	00.02	00.36	00.44	0.05-	0.08			5
			7124						0000	1		5	000.020	00.05	00.02	00.36	00.44	0.05-	0.08			5
			7126						0000	4		5	000.032	00.05	00.02	00.36	00.44	0.05-	0.08			5
			7127						0000	4		5	000.021	00.05	00.02	00.36	00.44	0.05-	0.08			5
			7129						0004	1		5	000.034	00.02	00.03	00.16	00.20	0.04-	0.05			5
			7130						0004	1		5	000.030	00.02	00.03	00.16	00.20	0.04-	0.05			5
			7132						0004	4		5	000.040	00.02	00.03	00.16	00.20	0.04-	0.05			5
			7133						0004	4		5	000.029	00.02	00.03	00.16	00.20	0.04-	0.05			5
			7135						0030	1		5	000.007	00.00	00.00	00.00	00.00	0.00	0.00			5
			7136						0030	1		5	000.010	00.00	00.00	00.00	00.00	0.00	0.00			5
			7138						0030	4		5	000.046	00.00	00.00	00.00	00.00	0.00	0.00			5
			7139						0030	4		5	000.055	00.00	00.00	00.00	00.00	0.00	0.00			5
			7141						0057	1		5	000.007	00.02	00.02-	00.32	00.32	0.06-	0.07			5
			7142						0057	1		5	000.009	00.02	00.02-	00.32	00.32	0.06-	0.07			5
			7144						0057	4		5	000.029	00.02	00.02-	00.32	00.32	0.06-	0.07			5
			7145						0057	4		5	000.031	00.02	00.02-	00.32	00.32	0.06-	0.07			5
			7147						0092	1		5	000.000	00.01	00.01-	00.21	00.21	0.05-	0.06			5
			7148						0092	1		5	000.002	00.01	00.01-	00.21	00.21	0.05-	0.06			5
			7150						0092	4		5	000.022	00.01	00.01-	00.21	00.21	0.05-	0.06			5
			7151						0092	4		5	000.028	00.01	00.01-	00.21	00.21	0.05-	0.06			5
		0191	7153	08	12/09/61	2325N	17748W		0000	1		5	000.034	00.02	00.00	00.35	00.37	0.06-	0.05			5
			7154						0000	1		5	000.069	00.02	00.00	00.35	00.37	0.06-	0.05			5
			7156						0000	4		5	000.152	00.02	00.00	00.35	00.37	0.06-	0.05			5

VE	CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1	2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR
NO	66	0191	7157	08	12/09/61	2325N	17748W	090	0000	4		5	000.127	00.02	00.00	00.35	00.37	0.06-	0.05			N066 5
			7158						0004	1		5	000.054	00.00	00.00	00.00	00.00	0.03-	0.04			5
			7159						0004	1		5	000.056	00.00	00.00	00.00	00.00	0.03-	0.04			5
			7161						0004	4		5	000.050	00.00	00.00	00.00	00.00	0.03-	0.04			5
			7162						0004	4		5	000.041	00.00	00.00	00.00	00.00	0.03-	0.04			5
			7163						0030	1		5	000.011	00.00	00.00	00.00	00.00	0.06-	0.04			5
			7164						0030	1		5	000.011	00.00	00.00	00.00	00.00	0.06-	0.04			5
			7166						0030	4		5	000.072	00.00	00.00	00.00	00.00	0.06-	0.04			5
			7167						0030	4		5	000.001	00.00	00.00	00.00	00.00	0.06-	0.04			5
			7168						0057	1		5	000.051	00.03	00.02	00.15	00.20	0.04-	0.06			5
			7169						0057	1*		5	000.010-	00.03	00.02	00.15	00.20	0.04-	0.06			5
			7171						0057	4*		5	000.009-	00.03	00.02	00.15	00.20	0.04-	0.06			5
			7172						0057	4*		5	000.004-	00.03	00.02	00.15	00.20	0.04-	0.06			5
			7173						0092	1		5	000.043	00.02	00.00	00.19	00.21	0.01-	0.02			5
			7174						0092	1		5	000.001	00.02	00.00	00.19	00.21	0.01-	0.02			5
			7176						0092	4		5	000.007	00.02	00.00	00.19	00.21	0.01-	0.02			5
			7177						0092	4		5	000.009	00.02	00.00	00.19	00.21	0.01-	0.02			5
		0194	7178	14		2322N	17758W		0000	1*		5	000.068-	00.02	00.00	00.19	00.21	0.03-	0.04			5
			7179						0000	1*		5	000.063-	00.02	00.00	00.19	00.21	0.03-	0.04			5
			7181						0000	2*		5	000.055-	00.02	00.00	00.19	00.21	0.03-	0.04			5
			7182						0000	2*		5	000.056-	00.02	00.00	00.19	00.21	0.03-	0.04			5
			7183						0006	1*		5	000.012-	00.06	00.03	00.59	00.67	0.06-	0.11			5
			7184						0006	1*		5	000.017-	00.06	00.03	00.59	00.67	0.06-	0.11			5
			7186						0006	2*		5	000.010-	00.06	00.03	00.59	00.67	0.06-	0.11			5
			7187						0006	2*		5	000.029-	00.06	00.03	00.59	00.67	0.06-	0.11			5
			7188						0029	1		5	000.007	00.06	00.03	00.45	00.54	0.02-	0.08			5
			7189						0029	1		5	000.007	00.06	00.03	00.45	00.54	0.02-	0.08			5
			7191						0029	2		5	000.056	00.06	00.03	00.45	00.54	0.02-	0.08			5
			7192						0029	2		5	000.038	00.06	00.03	00.45	00.54	0.02-	0.08			5
			7193						0043	1		5	000.003	00.06	00.01-	00.36	00.42	0.01	0.04			5
			7194						0043	1		5	000.002	00.06	00.01-	00.36	00.42	0.01	0.04			5
			7196						0043	2		5	000.027	00.06	00.01-	00.36	00.42	0.01	0.04			5
			7197						0043	2		5	000.008	00.06	00.01-	00.36	00.42	0.01	0.04			5
			7198						0096	1		5	000.017	00.03	00.03-	00.35	00.34	0.05-	0.06			5
			7199						0096	1*		5	000.041-	00.03	00.03-	00.35	00.34	0.05-	0.06			5
			7201						0096	2*		5	000.049-	00.03	00.03-	00.35	00.34	0.05-	0.06			5
			7202						0096	2*		5	000.042-	00.03	00.03-	00.35	00.34	0.05-	0.06			5
		0229	7203	07	13/09/61	2555N	17730W		0000	1		5	000.004	00.01	00.02	00.10	00.12	0.01-	0.02			5
			7204						0000	1		5	000.015	00.01	00.02	00.10	00.12	0.01-	0.02			5
			7206						0000	2		5	000.007	00.01	00.02	00.10	00.12	0.01-	0.02			5
			7207						0000	2*		5	000.010-	00.01	00.02	00.10	00.12	0.01-	0.02			5
			7208						0006	1		5	000.031	00.00	00.00	00.05	00.04	0.00	0.00			5
			7209						0006	1		5	000.009	00.00	00.00	00.05	00.04	0.00	0.00			5
			7211						0006	2		5	000.045	00.00	00.00	00.05	00.04	0.00	0.00			5
			7212						0006	2		5	000.038	00.00	00.00	00.05	00.04	0.00	0.00			5
			7213						0029	1		5	000.001	00.03	00.04	00.11	00.19	0.03-	0.06			5
			7214						0029	1		5	000.012	00.03	00.04	00.11	00.19	0.03-	0.06			5
			7216						0029	2		5	000.028	00.03	00.04	00.11	00.19	0.03-	0.06			5
			7217						0029	2		5	000.022	00.03	00.04	00.11	00.19	0.03-	0.06			5
			7218						0043	1*		5	000.004-	00.01	00.01-	00.04	00.04	0.01-	0.02			5
			7219						0043	1		5	000.004	00.01	00.01-	00.04	00.04	0.01-	0.02			5
			7221						0043	2		5	000.034	00.01	00.01-	00.04	00.04	0.01-	0.02			5

VE	CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1	2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR
NO	66	0229	7222	07	13/09/61	2555N	17730W	090	0043	2		5	000.026	00.01	00.01-	00.04	00.04	0.01-	0.02			N066 5
			7223						0096	1*		5	000.003-	00.04	00.02	00.26	00.32	0.01-	0.04			5
			7224						0096	1*		5	000.007-	00.04	00.02	00.26	00.32	0.01-	0.04			5
			7226						0096	2		5	000.017	00.04	00.02	00.26	00.32	0.01-	0.04			5
			7227						0096	2		5	000.018	00.04	00.02	00.26	00.32	0.01-	0.04			5
		0316	7266	13	15/09/61	3121N	17722W	126	0000	1*		5	000.002-	00.01	00.01-	00.04	00.04	0.01-	0.03			5
			7267						0000	1		5	000.027	00.01	00.01-	00.04	00.04	0.01-	0.03			5
			7269						0000	3		5	000.078	00.01	00.01-	00.04	00.04	0.01-	0.03			5
			7270						0000	3		5	000.069	00.01	00.01-	00.04	00.04	0.01-	0.03			5
			7271						0004	1		5	000.024	00.05	00.03	00.25	00.33	0.05-	0.07			5
			7272						0004	1		5	000.022	00.05	00.03	00.25	00.33	0.05-	0.07			5
			7274						0004	3		5	000.067	00.05	00.03	00.25	00.33	0.05-	0.07			5
			7275						0004	3		5	000.069	00.05	00.03	00.25	00.33	0.05-	0.07			5
			7276						0016	1*		5	000.001-	00.03	00.03-	00.26	00.26	0.01	0.02			5
			7277						0016	1		5	000.002	00.03	00.03-	00.26	00.26	0.01	0.02			5
			7279						0016	3		5	000.048	00.03	00.03-	00.26	00.26	0.01	0.02			5
			7280						0016	3		5	000.030	00.03	00.03-	00.26	00.26	0.01	0.02			5
			7281						0027	1		5	000.002	00.00	00.00	00.00	00.00	0.00	0.00			5
			7282						0027	1		5	000.005	00.00	00.00	00.00	00.00	0.00	0.00			5
			7284						0027	3		5	000.000	00.00	00.00	00.00	00.00	0.00	0.00			5
			7285						0027	3		5	000.013	00.00	00.00	00.00	00.00	0.00	0.00			5
			7286						0044	1*		5	000.001-	00.12	00.01-	00.67	00.77	0.07-	0.07			5
			7287						0044	1		5	000.002	00.12	00.01-	00.67	00.77	0.07-	0.07			5
			7289						0044	3*		5	000.002-	00.12	00.01-	00.67	00.77	0.07-	0.07			5
			7290						0044	3		5	000.005	00.12	00.01-	00.67	00.77	0.07-	0.07			5
		0349	7300	07	16/09/61	3315N	17719W		0000	1		5	000.103	00.00	00.02-	00.63	00.62	0.05-	0.04			5
			7301						0000	1		5	000.097	00.00	00.02-	00.63	00.62	0.05-	0.04			5
			7303						0000	4		5	000.138	00.00	00.02-	00.63	00.62	0.05-	0.04			5
			7304						0000	4		5	000.105	00.00	00.02-	00.63	00.62	0.05-	0.04			5
			7305						0004	1		5	000.070	00.01	00.01	00.40	00.42	0.04-	0.03			5
			7306						0004	1		5	000.079	00.01	00.01	00.40	00.42	0.04-	0.03			5
			7308						0004	4		5	000.155	00.01	00.01	00.40	00.42	0.04-	0.03			5
			7309						0004	4		5	000.129	00.01	00.01	00.40	00.42	0.04-	0.03			5
			7310						0016	1		5	000.025	00.13	00.07-	00.27	00.32	0.03-	0.03			5
			7311						0016	1		5	000.026	00.13	00.07-	00.27	00.32	0.03-	0.03			5
			7313						0016	4		5	000.161	00.13	00.07-	00.27	00.32	0.03-	0.03			5
			7314						0016	4		5	000.183	00.13	00.07-	00.27	00.32	0.03-	0.03			5
			7315						0027	1		5	000.011	00.06	00.09-	00.74	00.71	0.09-	0.08			5
			7316						0027	1		5	000.004	00.06	00.09-	00.74	00.71	0.09-	0.08			5
			7318						0027	4		5	000.102	00.06	00.09-	00.74	00.71	0.09-	0.08			5
			7319						0027	4		5	000.101	00.06	00.09-	00.74	00.71	0.09-	0.08			5
			7320						0044	1*		5	000.002-	00.06	00.02-	00.36	00.41	0.03-	0.03			5
			7321						0044	1*		5	000.003-	00.06	00.02-	00.36	00.41	0.03-	0.03			5
			7323						0044	4		5	000.141	00.06	00.02-	00.36	00.41	0.03-	0.03			5
			7324						0044	4		5	000.129	00.06	00.02-	00.36	00.41	0.03-	0.03			5
		0363	7325	13		3439N	17716W		0000	1		5	000.092	00.06	00.02-	00.26	00.30	0.02-	0.02			5
			7326						0000	1		5	000.081	00.06	00.02-	00.26	00.30	0.02-	0.02			5
			7328						0000	4		5	000.109	00.06	00.02-	00.26	00.30	0.02-	0.02			5
			7329						0000	4		5	000.131	00.06	00.02-	00.26	00.30	0.02-	0.02			5
			7330						0002	1		5	000.042	00.05	00.04	00.25	00.34	0.05-	0.04			5
			7331						0002	1		5	000.035	00.05	00.04	00.25	00.34	0.05-	0.04			5
			7333						0002	4		5	000.107	00.05	00.04	00.25	00.34	0.05-	0.04			5

VE CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1	2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR
NO 66	0363	7334	13	16/09/61	3439N	17716W	126	0002	4		5	000.115	00.05	00.04	00.25	00.34	0.05-	0.04			NO66 5
		7335	14					0008	1		5	000.005	00.05	00.02	00.28	00.36	0.04-	0.04			5
		7336						0008	1		5	000.013	00.05	00.02	00.28	00.36	0.04-	0.04			5
		7338						0008	4		5	000.144	00.05	00.02	00.28	00.36	0.04-	0.04			5
		7339						0008	4		5	000.108	00.05	00.02	00.28	00.36	0.04-	0.04			5
		7340						0019	1		5	000.007	00.08	00.06	00.33	00.46	0.00	0.03			5
		7341						0019	1		5	000.008	00.08	00.06	00.33	00.46	0.00	0.03			5
		7343						0019	4		5	000.110	00.08	00.06	00.33	00.46	0.00	0.03			5
		7344						0019	4		5	000.095	00.08	00.06	00.33	00.46	0.00	0.03			5
		7345						0038	1*		5	000.004-	00.29	00.30	01.86	02.45	0.13-	0.26			5
		7346						0038	1		5	000.017	00.29	00.30	01.86	02.45	0.13-	0.26			5
		7348						0038	4		5	000.105	00.29	00.30	01.86	02.45	0.13-	0.26			5
		7349						0038	4		5	000.123	00.29	00.30	01.86	02.45	0.13-	0.26			5
	0397	7350	07	17/09/61	3653N	17721W		0000	1		5	000.101	00.15	00.13	00.94	01.23	0.02-	0.07			5
		7351						0000	1		5	000.136	00.15	00.13	00.94	01.23	0.02-	0.07			5
		7353						0000	3		5	000.161	00.15	00.13	00.94	01.23	0.02-	0.07			5
		7354						0000	3		5	000.155	00.15	00.13	00.94	01.23	0.02-	0.07			5
		7355						0002	1		5	000.076	00.13	00.16	01.12	01.40	0.08-	0.06			5
		7356						0002	1		5	000.085	00.13	00.16	01.12	01.40	0.08-	0.06			5
		7358						0002	3		5	000.139	00.13	00.16	01.12	01.40	0.08-	0.06			5
		7359						0002	3		5	000.156	00.13	00.16	01.12	01.40	0.08-	0.06			5
		7360						0008	1		5	000.033	00.10	00.08	00.60	00.78	0.02	0.01			5
		7361						0008	1		5	000.026	00.10	00.08	00.60	00.78	0.02	0.01			5
		7363						0008	3		5	000.151	00.10	00.08	00.60	00.78	0.02	0.01			5
		7364						0008	3		5	000.160	00.10	00.08	00.60	00.78	0.02	0.01			5
		7365						0019	1*		5	000.001-	00.13	00.13	00.67	00.93	0.09-	0.09			5
		7366						0019	1		5	000.004	00.13	00.13	00.67	00.93	0.09-	0.09			5
		7368						0019	3		5	000.044	00.13	00.13	00.67	00.93	0.09-	0.09			5
		7369						0019	3		5	000.074	00.13	00.13	00.67	00.93	0.09-	0.09			5
		7370	08					0038	1		5	000.002	00.09	00.12	00.74	00.95	0.02-	0.04			5
		7371						0038	1		5	000.000	00.09	00.12	00.74	00.95	0.02-	0.04			5
		7373						0038	3*		5	000.001-	00.09	00.12	00.74	00.95	0.02-	0.04			5
		7374						0038	3		5	000.013	00.09	00.12	00.74	00.95	0.02-	0.04			5
	0481	7387	13	19/09/61	4035N	17704W	162	0000	2		5	000.257	00.07	00.04	00.36	00.46	0.02-	0.04			5
		7387						0000	1		5	000.257	00.07	00.04	00.36	00.46	0.02-	0.04			5
		7388						0000	2		5	000.239	00.07	00.04	00.36	00.46	0.02-	0.04			5
		7388						0000	1		5	000.239	00.07	00.04	00.36	00.46	0.02-	0.04			5
		7390						0003	1		5	000.214	00.08	00.01-	00.62	00.70	0.01-	0.04			5
		7391						0003	1		5	000.229	00.08	00.01-	00.62	00.70	0.01-	0.04			5
		7393						0003	2		5	000.308	00.08	00.01-	00.62	00.70	0.01-	0.04			5
		7394						0003	2		5	000.291	00.08	00.01-	00.62	00.70	0.01-	0.04			5
		7395						0017	1		5	000.101	00.06	00.08	00.38	00.52	0.03-	0.02			5
		7396						0017	1		5	000.086	00.06	00.08	00.38	00.52	0.03-	0.02			5
		7398						0017	2		5	000.325	00.06	00.08	00.38	00.52	0.03-	0.02			5
		7399						0017	2		5	000.315	00.06	00.08	00.38	00.52	0.03-	0.02			5
		7400						0031	1		5	000.052	00.11	00.00	00.53	00.64	0.04-	0.05			5
		7401						0031	1		5	000.043	00.11	00.00	00.53	00.64	0.04-	0.05			5
		7403						0031	2		5	000.330	00.11	00.00	00.53	00.64	0.04-	0.05			5
		7404						0031	2		5	000.303	00.11	00.00	00.53	00.64	0.04-	0.05			5
		7405	14					0053	1*		5	000.004-	00.12	00.13	00.28	00.53	0.00	0.05			5
		7406						0053	1*		5	000.015-	00.12	00.13	00.28	00.53	0.00	0.05			5
		7408						0053	2		5	000.394	00.12	00.13	00.28	00.53	0.00	0.05			5

VE	CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1	2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR
NO	66	0481	7409	14	19/09/61	4035N	17704W	162	0053	2		5	000.351	00.12	00.13	00.28	00.53	0.00	0.05			N066 5
		0515	7410	07	20/09/61	4223N	17657W		0000	2		5	000.362	00.06	00.10	00.26	00.42	0.03-	0.06			5
			7410						0000	1		5	000.362	00.06	00.10	00.26	00.42	0.03-	0.06			5
			7411						0000	2		5	000.342	00.06	00.10	00.26	00.42	0.03-	0.06			5
			7411						0000	1		5	000.342	00.06	00.10	00.26	00.42	0.03-	0.06			5
			7413						0003	1		5	000.330	00.03	00.18	00.25-	00.04-	0.03-	0.03			5
			7414						0003	1		5	000.367	00.03	00.18	00.25-	00.04-	0.03-	0.03			5
			7416						0003	2		5	000.450	00.03	00.18	00.25-	00.04-	0.03-	0.03			5
			7417						0003	2		5	000.468	00.03	00.18	00.25-	00.04-	0.03-	0.03			5
			7418						0017	1		5	000.134	00.07	00.04	00.58	00.69	0.01-	0.04			5
			7419						0017	1		5	000.143	00.07	00.04	00.58	00.69	0.01-	0.04			5
			7421						0017	2		5	000.442	00.07	00.04	00.58	00.69	0.01-	0.04			5
			7422						0017	2		5	000.473	00.07	00.04	00.58	00.69	0.01-	0.04			5
			7423						0031	1		5	000.030	00.03	00.07	00.22	00.33	0.01	0.02			5
			7424						0031	1		5	000.044	00.03	00.07	00.22	00.33	0.01	0.02			5
			7426						0031	2		5	000.516	00.03	00.07	00.22	00.33	0.01	0.02			5
			7427						0031	2		5	000.591	00.03	00.07	00.22	00.33	0.01	0.02			5
			7428						0053	1		5	000.009	00.10	00.13	00.02	00.25	0.01-	0.04			5
			7429						0053	1		5	000.010	00.10	00.13	00.02	00.25	0.01-	0.04			5
			7431						0053	2		5	000.391	00.10	00.13	00.02	00.25	0.01-	0.04			5
			7432						0053	2		5	000.398	00.10	00.13	00.02	00.25	0.01-	0.04			5
		0567	7469	14	21/09/61	4551N	17644W		0000	1		5	000.420	00.24	00.22	00.12-	00.35	0.19	0.00			5
			7470						0000	1		5	000.402	00.24	00.22	00.12-	00.35	0.19	0.00			5
			7472						0000	3		5	000.444	00.24	00.22	00.12-	00.35	0.19	0.00			5
			7473						0000	3		5	000.515	00.24	00.22	00.12-	00.35	0.19	0.00			5
			7474						0002	1		5	000.374	00.16	00.05	00.12	00.33	0.03	0.02			5
			7475						0002	1		5	000.375	00.16	00.05	00.12	00.33	0.03	0.02			5
			7477						0002	3		5	000.572	00.16	00.05	00.12	00.33	0.03	0.02			5
			7478						0002	3		5	000.612	00.16	00.05	00.12	00.33	0.03	0.02			5
			7479						0018	1		5	000.233	00.15	00.03	00.21-	00.03-	0.02	0.01			5
			7480						0018	1		5	000.299	00.15	00.03	00.21-	00.03-	0.02	0.01			5
			7482						0018	3		5	000.536	00.15	00.03	00.21-	00.03-	0.02	0.01			5
			7483						0018	3		5	000.387	00.15	00.03	00.21-	00.03-	0.02	0.01			5
			7484						0027	1		5	000.150	00.18	00.13	00.28	00.59	0.01	0.03			5
			7485						0027	1		5	000.097	00.18	00.13	00.28	00.59	0.01	0.03			5
			7487						0027	3		5	000.234	00.18	00.13	00.28	00.59	0.01	0.03			5
			7488						0027	3		5	000.193	00.18	00.13	00.28	00.59	0.01	0.03			5
			7489						0039	1		5	000.016	00.10	00.15	00.30-	00.05-	0.01	0.03			5
			7490						0039	1		5	000.147	00.10	00.15	00.30-	00.05-	0.01	0.03			5
			7492						0039	3		5	000.028	00.10	00.15	00.30-	00.05-	0.01	0.03			5
			7493						0039	3		5	000.037	00.10	00.15	00.30-	00.05-	0.01	0.03			5
		0589	7503	07	22/09/61	4637N			0000	1		5	000.350	00.27	00.18	00.21	00.66	0.01	0.06			5
			7504						0000	1		5	000.358	00.27	00.18	00.21	00.66	0.01	0.06			5
			7506						0000	3		5	000.433	00.27	00.18	00.21	00.66	0.01	0.06			5
			7507						0000	3		5	000.511	00.27	00.18	00.21	00.66	0.01	0.06			5
			7508						0002	1		5	000.305	00.11	00.03	00.22	00.36	0.05	0.01			5
			7509						0002	1		5	000.263	00.11	00.03	00.22	00.36	0.05	0.01			5
			7511						0002	3		5	000.501	00.11	00.03	00.22	00.36	0.05	0.01			5
			7512						0002	3		5	000.624	00.11	00.03	00.22	00.36	0.05	0.01			5
			7513						0018	1		5	000.095	00.04	00.00	00.23	00.27	0.02	0.01			5
			7514						0018	1		5	000.086	00.04	00.00	00.23	00.27	0.02	0.01			5
			7516						0018	3		5	000.320	00.04	00.00	00.23	00.27	0.02	0.01			5

VE	CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1	2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR
NO	66	0589	7517	07	22/09/61	4637N	17644W	162	0018	3		5	000.422	00.04	00.00	00.23	00.27	0.02	0.01			N066 5
			7518						0027	1		5	000.021	00.16	00.08	00.42	00.67	0.03	0.04			5
			7519						0027	1		5	000.026	00.16	00.08	00.42	00.67	0.03	0.04			5
			7521						0027	3		5	000.162	00.16	00.08	00.42	00.67	0.03	0.04			5
			7522						0027	3		5	000.221	00.16	00.08	00.42	00.67	0.03	0.04			5
			7523						0039	1*		5	000.065-	00.06	00.01-	00.21	00.26	0.02	0.03			5
			7524						0039	1*		5	000.058-	00.06	00.01-	00.21	00.26	0.02	0.03			5
			7526						0039	3*		5	000.025-	00.06	00.01-	00.21	00.26	0.02	0.03			5
			7527						0039	3*		5	000.020-	00.06	00.01-	00.21	00.26	0.02	0.03			5
		0604	7531	13		4805N	17636W		0000	1		5	000.398	00.11	00.08	00.53	00.73	0.01	0.06			5
			7532						0000	1		5	000.371	00.11	00.08	00.53	00.73	0.01	0.06			5
			7534						0000	4		5	000.254	00.11	00.08	00.53	00.73	0.01	0.06			5
			7535						0000	4		5	000.186	00.11	00.08	00.53	00.73	0.01	0.06			5
			7536						0002	1		5	000.269	00.11	00.01	00.58	00.71	0.00	0.07			5
			7537						0002	1		5	000.300	00.11	00.01	00.58	00.71	0.00	0.07			5
			7539						0002	4		5	000.318	00.11	00.01	00.58	00.71	0.00	0.07			5
			7540						0002	4		5	000.295	00.11	00.01	00.58	00.71	0.00	0.07			5
			7541						0009	1		5	000.134	00.09	00.03	00.37	00.49	0.01	0.04			5
			7542						0009	1		5	000.180	00.09	00.03	00.37	00.49	0.01	0.04			5
			7544						0009	4		5	000.343	00.09	00.03	00.37	00.49	0.01	0.04			5
			7545						0009	4		5	000.305	00.09	00.03	00.37	00.49	0.01	0.04			5
			7546						0022	1		5	000.088	00.07	00.05	00.24	00.36	0.00	0.05			5
			7547						0022	1		5	000.067	00.07	00.05	00.24	00.36	0.00	0.05			5
			7549						0022	4		5	000.358	00.07	00.05	00.24	00.36	0.00	0.05			5
			7550						0022	4		5	000.305	00.07	00.05	00.24	00.36	0.00	0.05			5
			7551	14					0049	1		5	000.002	00.06	00.04	00.01	00.11	0.03	0.02			5
			7552						0049	1		5	000.004	00.06	00.04	00.01	00.11	0.03	0.02			5
			7554						0049	4		5	000.020	00.06	00.04	00.01	00.11	0.03	0.02			5
			7555						0049	4		5	000.053	00.06	00.04	00.01	00.11	0.03	0.02			5
		0640	7556	07	23/09/61	5022N	17633W	198	0000	1		5	002.097	00.53	00.21	00.94	01.69	0.02-	0.16			5
			7557						0000	1		5	001.651	00.53	00.21	00.94	01.69	0.02-	0.16			5
			7559						0000	4		5	001.571	00.53	00.21	00.94	01.69	0.02-	0.16			5
			7560						0000	4		5	001.426	00.53	00.21	00.94	01.69	0.02-	0.16			5
			7561						0002	1		5	002.379	00.45	00.14	00.95	01.54	0.03-	0.21			5
			7562						0002	1		5	001.577	00.45	00.14	00.95	01.54	0.03-	0.21			5
			7564						0002	4		5	001.441	00.45	00.14	00.95	01.54	0.03-	0.21			5
			7565						0002	4		5	001.418	00.45	00.14	00.95	01.54	0.03-	0.21			5
			7566						0009	1		5	000.977	00.19	00.01	00.14	00.34	0.02-	0.06			5
			7567						0009	1		5	000.785	00.19	00.01	00.14	00.34	0.02-	0.06			5
			7569						0009	4		5	001.689	00.19	00.01	00.14	00.34	0.02-	0.06			5
			7570						0009	4		5	001.525	00.19	00.01	00.14	00.34	0.02-	0.06			5
			7571						0022	1		5	000.429	00.38	00.19	00.71	01.27	0.20-	0.17			5
			7572						0022	1		5	000.399	00.38	00.19	00.71	01.27	0.20-	0.17			5
			7574						0022	4		5	001.409	00.38	00.19	00.71	01.27	0.20-	0.17			5
			7575						0022	4		5	001.361	00.38	00.19	00.71	01.27	0.20-	0.17			5
			7576						0049	1*		5	000.055-	00.12	00.03	00.24	00.39	0.20	0.01-			5
			7577						0049	1*		5	000.059-	00.12	00.03	00.24	00.39	0.20	0.01-			5
			7579						0049	4		5	000.093	00.12	00.03	00.24	00.39	0.20	0.01-			5
			7580						0049	4		5	000.006	00.12	00.03	00.24	00.39	0.20	0.01-			5
		0646	7611	14		5028N	17627W		0000	2		5	001.550	00.56	00.18	00.86	01.60	0.02-	0.16			5
			7611						0000	1		5	001.550	00.56	00.18	00.86	01.60	0.02-	0.16			5
			7612						0000	2		5	001.323	00.56	00.18	00.86	01.60	0.02-	0.16			5

VE	CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1	2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR
NO	66	0646	7612	14	23/09/61	5028N	17627W	198	0000	1		5	001.323	00.56	00.18	00.86	01.60	0.02-	0.16			N066 5
			7614						0002	1		5	001.426	00.26	00.11	00.59	00.96	0.01-	0.10			5
			7615						0002	1		5	001.425	00.26	00.11	00.59	00.96	0.01-	0.10			5
			7617						0002	2		5	000.752	00.26	00.11	00.59	00.96	0.01-	0.10			5
			7618						0002	2		5	000.613	00.26	00.11	00.59	00.96	0.01-	0.10			5
			7619						0006	1		5	000.719	00.15	00.09	00.36	00.60	0.00	0.04			5
			7620						0006	1		5	000.599	00.15	00.09	00.36	00.60	0.00	0.04			5
			7622						0006	2		5	000.582	00.15	00.09	00.36	00.60	0.00	0.04			5
			7623						0006	2		5	000.666	00.15	00.09	00.36	00.60	0.00	0.04			5
			7624						0010	1		5	000.277	00.12	00.04	00.15	00.31	0.03	0.01			5
			7625						0010	1		5	000.308	00.12	00.04	00.15	00.31	0.03	0.01			5
			7627						0010	2		5	000.679	00.12	00.04	00.15	00.31	0.03	0.01			5
			7628						0010	2		5	000.709	00.12	00.04	00.15	00.31	0.03	0.01			5
			7629						0021	1		5	000.027	00.19	00.07	00.38	00.64	0.00	0.03			5
			7630						0021	1		5	000.021	00.19	00.07	00.38	00.64	0.00	0.03			5
			7632						0021	2		5	000.638	00.19	00.07	00.38	00.64	0.00	0.03			5
			7633						0021	2		5	000.680	00.19	00.07	00.38	00.64	0.00	0.03			5
		1092	7634	11	27/09/61	5133N	16840W	197	0000	1		5	000.448	00.18	00.23	00.69	01.10	0.04-	0.15			5
			7635						0000	1		5	000.432	00.18	00.23	00.69	01.10	0.04-	0.15			5
			7637						0000	3		5	000.263	00.18	00.23	00.69	01.10	0.04-	0.15			5
			7638						0000	3		5	000.230	00.18	00.23	00.69	01.10	0.04-	0.15			5
			7639	12					0001	1		5	000.291	00.11	00.08	00.51	00.70	0.05-	0.10			5
			7640						0001	1		5	000.331	00.11	00.08	00.51	00.70	0.05-	0.10			5
			7642						0001	3		5	000.230	00.11	00.08	00.51	00.70	0.05-	0.10			5
			7643						0001	3		5	000.233	00.11	00.08	00.51	00.70	0.05-	0.10			5
			7644						0003	1		5	000.290	00.03	00.00	00.01	00.03	0.02	0.00			5
			7645						0003	1		5	000.216	00.03	00.00	00.01	00.03	0.02	0.00			5
			7647						0003	3		5	000.183	00.03	00.00	00.01	00.03	0.02	0.00			5
			7648						0003	3		5	000.188	00.03	00.00	00.01	00.03	0.02	0.00			5
			7649						0010	1		5	000.093	00.10	00.05	00.61	00.75	0.02-	0.06			5
			7650						0010	1		5	000.094	00.10	00.05	00.61	00.75	0.02-	0.06			5
			7652						0010	3		5	000.107	00.10	00.05	00.61	00.75	0.02-	0.06			5
			7653						0010	3		5	000.092	00.10	00.05	00.61	00.75	0.02-	0.06			5
			7654						0025	1*		5	000.005-	00.00	00.00	00.00	00.00	0.00	0.00			5
			7655						0025	1*		5	000.005-	00.00	00.00	00.00	00.00	0.00	0.00			5
			7657						0025	3		5	000.031	00.00	00.00	00.00	00.00	0.00	0.00			5
			7658						0025	3		5	000.021	00.00	00.00	00.00	00.00	0.00	0.00			5
		1131	7668	07	28/09/61	5149N	16301W		0000	1		5	000.519	00.16	00.08	00.06-	00.17	0.05-	0.04			5
			7669						0000	1		5	000.524	00.16	00.08	00.06-	00.17	0.05-	0.04			5
			7671						0000	3		5	000.422	00.16	00.08	00.06-	00.17	0.05-	0.04			5
			7672						0000	3		5	000.404	00.16	00.08	00.06-	00.17	0.05-	0.04			5
			7673						0001	1		5	000.552	00.09	00.03	00.10-	00.02	0.00	0.00			5
			7674						0001	1		5	000.585	00.09	00.03	00.10-	00.02	0.00	0.00			5
			7676						0001	3		5	000.516	00.09	00.03	00.10-	00.02	0.00	0.00			5
			7677						0001	3		5	000.542	00.09	00.03	00.10-	00.02	0.00	0.00			5
			7678						0003	1		5	000.432	00.09	00.02	00.31	00.42	0.03-	0.02			5
			7679						0003	1		5	000.389	00.09	00.02	00.31	00.42	0.03-	0.02			5
			7681						0003	3		5	000.351	00.09	00.02	00.31	00.42	0.03-	0.02			5
			7682						0003	3		5	000.422	00.09	00.02	00.31	00.42	0.03-	0.02			5
			7683						0010	1		5	000.161	00.21	00.13	01.04	01.38	0.25-	0.24			5
			7684						0010	1		5	000.149	00.21	00.13	01.04	01.38	0.25-	0.24			5
			7686						0010	3		5	000.246	00.21	00.13	01.04	01.38	0.25-	0.24			5

VE	CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1	2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR
NO	66	1131	7687	07	28/09/61	5149N	16301W	197	0010	3		5	000.206	00.21	00.13	01.04	01.38	0.25-	0.24			NO66 5
			7688						0025	1		5	000.006	00.07	00.03-	00.04	00.09	0.03-	0.03			5
			7689						0025	1		5	000.021	00.07	00.03-	00.04	00.09	0.03-	0.03			5
			7691						0025	3		5	000.388	00.07	00.03-	00.04	00.09	0.03-	0.03			5
			7692						0025	3		5	000.053	00.07	00.03-	00.04	00.09	0.03-	0.03			5
		1145	7723	12		5231N	16203W		0000	1		5	002.281	00.28	00.13	00.16	00.57	0.01-	0.02			5
			7724						0000	1		5	002.478	00.28	00.13	00.16	00.57	0.01-	0.02			5
			7726						0000	4		5	001.354	00.28	00.13	00.16	00.57	0.01-	0.02			5
			7727						0000	4		5	001.644	00.28	00.13	00.16	00.57	0.01-	0.02			5
			7728						0002	1		5	001.801	00.27	00.09	00.20	00.57	0.03-	0.05			5
			7729						0002	1		5	001.488	00.27	00.09	00.20	00.57	0.03-	0.05			5
			7731						0002	4		5	001.377	00.27	00.09	00.20	00.57	0.03-	0.05			5
			7732						0002	4		5	001.995	00.27	00.09	00.20	00.57	0.03-	0.05			5
			7733						0007	1		5	001.120	00.29	00.14	00.30	00.74	0.05-	0.09			5
			7734						0007	1		5	000.934	00.29	00.14	00.30	00.74	0.05-	0.09			5
			7736						0007	4		5	001.855	00.29	00.14	00.30	00.74	0.05-	0.09			5
			7737						0007	4		5	001.490	00.29	00.14	00.30	00.74	0.05-	0.09			5
			7738						0014	1		5	000.293	00.32	00.20	00.36	00.89	0.13-	0.12			5
			7739						0014	1		5	000.306	00.32	00.20	00.36	00.89	0.13-	0.12			5
			7741						0014	4		5	001.146	00.32	00.20	00.36	00.89	0.13-	0.12			5
			7742						0014	4		5	001.289	00.32	00.20	00.36	00.89	0.13-	0.12			5
			7743						0025	1		5	000.032	00.19	00.05	00.16	00.40	0.00	0.01			5
			7744						0025	1		5	000.060	00.19	00.05	00.16	00.40	0.00	0.01			5
			7746						0025	4		5	000.697	00.19	00.05	00.16	00.40	0.00	0.01			5
			7747						0025	4		5	000.716	00.19	00.05	00.16	00.40	0.00	0.01			5
		1186	7757	06	29/09/61	5341N	16119W		0000	1		5	005.044	00.10	00.02	00.14-	00.02-	0.00	0.00			5
			7758						0000	1		5	004.887	00.10	00.02	00.14-	00.02-	0.00	0.00			5
			7760						0000	4		5	003.305	00.10	00.02	00.14-	00.02-	0.00	0.00			5
			7761						0000	4		5	003.823	00.10	00.02	00.14-	00.02-	0.00	0.00			5
			7762						0002	1		5	003.384	00.36	00.15	00.31	00.83	0.03-	0.07			5
			7763						0002	1		5	003.544	00.36	00.15	00.31	00.83	0.03-	0.07			5
			7765						0002	4		5	003.425	00.36	00.15	00.31	00.83	0.03-	0.07			5
			7766						0002	4		5	003.305	00.36	00.15	00.31	00.83	0.03-	0.07			5
			7767						0007	1		5	002.787	00.29	00.15	00.21	00.65	0.01-	0.01			5
			7768						0007	1		5	003.078	00.29	00.15	00.21	00.65	0.01-	0.01			5
			7770						0007	4		5	002.835	00.29	00.15	00.21	00.65	0.01-	0.01			5
			7771						0007	4		5	003.382	00.29	00.15	00.21	00.65	0.01-	0.01			5
			7772						0014	1		5	000.708	00.35	00.12	00.06	00.53	0.09-	0.07			5
			7773						0014	1		5	000.790	00.35	00.12	00.06	00.53	0.09-	0.07			5
			7775						0014	4		5	003.058	00.35	00.12	00.06	00.53	0.09-	0.07			5
			7776						0014	4		5	002.976	00.35	00.12	00.06	00.53	0.09-	0.07			5
			7777						0025	1		5	000.064	00.00	00.00	00.00	00.00	0.00	0.00			5
			7778						0025	1		5	000.091	00.00	00.00	00.00	00.00	0.00	0.00			5
			7780						0025	4		5	000.589	00.00	00.00	00.00	00.00	0.00	0.00			5
			7781						0025	4		5	000.612	00.00	00.00	00.00	00.00	0.00	0.00			5
		1201	7782	12		5244N	16111W		0000	2		5	001.795	00.59	00.18	00.34	01.12	0.14	0.01			5
			7782						0000	1		5	001.795	00.59	00.18	00.34	01.12	0.14	0.01			5
			7783						0000	2		5	002.052	00.59	00.18	00.34	01.12	0.14	0.01			5
			7783						0000	1		5	002.052	00.59	00.18	00.34	01.12	0.14	0.01			5
			7785						0002	1		5	002.593	00.49	00.17	00.18	00.84	0.12	0.00			5
			7786						0002	1		5	002.277	00.49	00.17	00.18	00.84	0.12	0.00			5
			7788						0002	2		5	002.850	00.49	00.17	00.18	00.84	0.12	0.00			5

VE	CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1	2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR	
NO	66	1201	7789	12	29/09/61	5244N	16111W	197	0002	2		5	003.148	00.49	00.17	00.18	00.84	0.12	0.00			NO66	5
			7790						0010	1		5	001.050	00.56	00.18	00.22	00.96	0.04	0.07				5
			7791						0010	1		5	001.044	00.56	00.18	00.22	00.96	0.04	0.07				5
			7793						0010	2		5	002.737	00.56	00.18	00.22	00.96	0.04	0.07				5
			7794						0010	2		5	002.751	00.56	00.18	00.22	00.96	0.04	0.07				5
			7795						0020	1		5	000.173	00.56	00.16	00.23	00.95	0.06	0.06				5
			7796						0020	1		5	000.360	00.56	00.16	00.23	00.95	0.06	0.06				5
			7798						0020	2		5	002.859	00.56	00.16	00.23	00.95	0.06	0.06				5
			7799						0020	2		5	002.815	00.56	00.16	00.23	00.95	0.06	0.06				5
			7800	13					0028	1		5	000.057	00.50	00.16	00.38	01.03	0.07	0.05				5
			7801						0028	1		5	000.027	00.50	00.16	00.38	01.03	0.07	0.05				5
			7803						0028	2		5	002.754	00.50	00.16	00.38	01.03	0.07	0.05				5
			7804						0028	2		5	002.718	00.50	00.16	00.38	01.03	0.07	0.05				5
		1240	7805	07	30/09/61	4950N	16100W	161	0000	2		5	000.543	00.12	00.07	00.21-	00.03-	0.02	0.01-				5
			7805						0000	1		5	000.543	00.12	00.07	00.21-	00.03-	0.02	0.01-				5
			7806						0000	2		5	000.652	00.12	00.07	00.21-	00.03-	0.02	0.01-				5
			7806						0000	1		5	000.652	00.12	00.07	00.21-	00.03-	0.02	0.01-				5
			7808						0002	1		5	000.622	00.25	00.16	00.08	00.50	0.02	0.04				5
			7809						0002	1		5	000.365	00.25	00.16	00.08	00.50	0.02	0.04				5
			7811						0002	2		5	000.891	00.25	00.16	00.08	00.50	0.02	0.04				5
			7812						0002	2		5	000.881	00.25	00.16	00.08	00.50	0.02	0.04				5
			7813						0010	1		5	000.272	00.13	00.08	00.04	00.25	0.03	0.01				5
			7814						0010	1		5	000.308	00.13	00.08	00.04	00.25	0.03	0.01				5
			7816						0010	2		5	000.865	00.13	00.08	00.04	00.25	0.03	0.01				5
			7817						0010	2		5	000.865	00.13	00.08	00.04	00.25	0.03	0.01				5
			7818						0020	1		5	000.090	00.19	00.14	00.02-	00.31	0.01-	0.04				5
			7819						0020	1		5	000.084	00.19	00.14	00.02-	00.31	0.01-	0.04				5
			7821						0020	2		5	000.791	00.19	00.14	00.02-	00.31	0.01-	0.04				5
			7822						0020	2		5	000.867	00.19	00.14	00.02-	00.31	0.01-	0.04				5
			7823						0028	1		5	000.006	00.16	00.10	00.06	00.32	0.03	0.01				5
			7824						0028	1		5	000.008	00.16	00.10	00.06	00.32	0.03	0.01				5
			7826						0028	2		5	000.792	00.16	00.10	00.06	00.32	0.03	0.01				5
			7827						0028	2		5	000.764	00.16	00.10	00.06	00.32	0.03	0.01				5
		1245	7834	14		4952N	16048W		0000	1		5	000.553	00.17	00.11	00.06	00.33	0.00	0.04				5
			7835						0000	1		5	000.642	00.17	00.11	00.06	00.33	0.00	0.04				5
			7837						0000	3		5	000.293	00.17	00.11	00.06	00.33	0.00	0.04				5
			7838						0000	3		5	000.247	00.17	00.11	00.06	00.33	0.00	0.04				5
			7839						0001	1		5	000.463	00.11	00.08	00.04-	00.15	0.02	0.00				5
			7840						0001	1		5	000.401	00.11	00.08	00.04-	00.15	0.02	0.00				5
			7842						0001	3		5	000.191	00.11	00.08	00.04-	00.15	0.02	0.00				5
			7843						0001	3		5	000.185	00.11	00.08	00.04-	00.15	0.02	0.00				5
			7844						0005	1		5	000.271	00.09	00.04	00.33-	00.20-	0.04	0.02-				5
			7845						0005	1		5	000.282	00.09	00.04	00.33-	00.20-	0.04	0.02-				5
			7847						0005	3		5	000.030	00.09	00.04	00.33-	00.20-	0.04	0.02-				5
			7848						0005	3		5	000.056	00.09	00.04	00.33-	00.20-	0.04	0.02-				5
			7849						0010	1		5	000.130	00.05	00.08	00.16-	00.02-	0.00	0.00				5
			7850						0010	1		5	000.135	00.05	00.08	00.16-	00.02-	0.00	0.00				5
			7852						0010	3		5	000.033	00.05	00.08	00.16-	00.02-	0.00	0.00				5
			7853						0010	3		5	000.027	00.05	00.08	00.16-	00.02-	0.00	0.00				5
			7854						0039	1		5	000.002	00.09	00.07	00.19-	00.03-	0.00	0.00				5
			7855						0039	1		5	000.014	00.09	00.07	00.19-	00.03-	0.00	0.00				5
			7857						0039	3		5	000.007	00.09	00.07	00.19-	00.03-	0.00	0.00				5

VE	CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1	2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR
NO	66	1245	7858	14	30/09/61	4952N	16048W	161	0039	3		5	000.009	00.09	00.07	00.19-	00.03-	0.00	0.00			N066 5
		1275	7859	08	01/10/61	4816N	16039W		0000	1		5	000.639	00.07	00.11	00.21-	00.03-	0.00	0.00			5
			7860						0000	1		5	000.758	00.07	00.11	00.21-	00.03-	0.00	0.00			5
			7862						0000	3		5	000.530	00.07	00.11	00.21-	00.03-	0.00	0.00			5
			7863						0000	3		5	000.633	00.07	00.11	00.21-	00.03-	0.00	0.00			5
			7864						0001	1		5	000.843	00.06	00.07	00.16-	00.02-	0.01-	0.00			5
			7865						0001	1		5	000.967	00.06	00.07	00.16-	00.02-	0.01-	0.00			5
			7867						0001	3		5	000.596	00.06	00.07	00.16-	00.02-	0.01-	0.00			5
			7868						0001	3		5	000.632	00.06	00.07	00.16-	00.02-	0.01-	0.00			5
			7869						0005	1		5	000.488	00.07	00.10	00.20-	00.03-	0.00	0.00			5
			7870						0005	1		5	000.402	00.07	00.10	00.20-	00.03-	0.00	0.00			5
			7872						0005	3		5	000.476	00.07	00.10	00.20-	00.03-	0.00	0.00			5
			7873						0005	3		5	000.487	00.07	00.10	00.20-	00.03-	0.00	0.00			5
			7874						0010	1		5	000.211									5
			7875						0010	1		5	000.162									5
			7877						0010	3		5	000.142									5
			7878						0010	3		5	000.161									5
			7879						0039	1		5	000.025	00.06	00.08	00.16-	00.02-	0.01	0.01-			5
			7880						0039	1		5	000.036	00.06	00.08	00.16-	00.02-	0.01	0.01-			5
			7882						0039	3		5	000.018	00.06	00.08	00.16-	00.02-	0.01	0.01-			5
			7883						0039	3		5	000.037	00.06	00.08	00.16-	00.02-	0.01	0.01-			5
		1368	7917	13	03/10/61	4347N	16035W		0000	1		5	000.392	00.05	00.02	00.51	00.59	0.02-	0.02			5
			7918						0000	1		5	000.321	00.05	00.02	00.51	00.59	0.02-	0.02			5
			7920						0000	4		5	000.402	00.05	00.02	00.51	00.59	0.02-	0.02			5
			7921						0000	4		5	000.408	00.05	00.02	00.51	00.59	0.02-	0.02			5
			7922						0001	1		5	000.317	00.05	00.03	00.33	00.41	0.01-	0.02			5
			7923						0001	1		5	000.334	00.05	00.03	00.33	00.41	0.01-	0.02			5
			7925						0001	4		5	000.491	00.05	00.03	00.33	00.41	0.01-	0.02			5
			7926						0001	4		5	000.381	00.05	00.03	00.33	00.41	0.01-	0.02			5
			7927						0004	1		5	000.156	00.08	00.05	00.42	00.55	0.03-	0.04			5
			7928						0004	1		5	000.141	00.08	00.05	00.42	00.55	0.03-	0.04			5
			7930						0004	4		5	000.462	00.08	00.05	00.42	00.55	0.03-	0.04			5
			7931						0004	4		5	000.450	00.08	00.05	00.42	00.55	0.03-	0.04			5
			7932						0015	1		5	000.030	00.09	00.00	00.36	00.46	0.01	0.01			5
			7933						0015	1		5	000.056	00.09	00.00	00.36	00.46	0.01	0.01			5
			7935						0015	4		5	000.511	00.09	00.00	00.36	00.46	0.01	0.01			5
			7936						0015	4		5	000.475	00.09	00.00	00.36	00.46	0.01	0.01			5
			7937						0027	1		5	000.000	00.14	00.01-	00.72	00.86	0.08-	0.07			5
			7938						0027	1*		5	000.004-	00.14	00.01-	00.72	00.86	0.08-	0.07			5
			7940						0027	4		5	000.445	00.14	00.01-	00.72	00.86	0.08-	0.07			5
			7941						0027	4		5	000.318	00.14	00.01-	00.72	00.86	0.08-	0.07			5
		1389	7942	06	04/10/61	4220N	16032W		0000	1		5	000.739	00.11	00.02	00.21	00.34	0.00	0.02			5
			7943						0000	1		5	000.599	00.11	00.02	00.21	00.34	0.00	0.02			5
			7945						0000	4		5	000.758	00.11	00.02	00.21	00.34	0.00	0.02			5
			7946						0000	4		5	000.802	00.11	00.02	00.21	00.34	0.00	0.02			5
			7947						0001	1		5	000.604	00.21	00.11	00.73	01.05	0.04-	0.09			5
			7948						0001	1		5	000.556	00.21	00.11	00.73	01.05	0.04-	0.09			5
			7950						0001	4		5	000.823	00.21	00.11	00.73	01.05	0.04-	0.09			5
			7951						0001	4		5	000.929	00.21	00.11	00.73	01.05	0.04-	0.09			5
			7952						0004	1		5	000.174	00.16	00.06	00.46	00.68	0.04-	0.06			5
			7953						0004	1		5	000.227	00.16	00.06	00.46	00.68	0.04-	0.06			5
			7955						0004	4		5	000.928	00.16	00.06	00.46	00.68	0.04-	0.06			5

VE	CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1	2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR
NO	66	1389	7956	06	04/10/61	4220N	16032W	161	0004	4		5	000.884	00.16	00.06	00.46	00.68	0.04-	0.06			N066 5
			7957						0015	1		5	000.023	00.16	00.06	00.49	00.72	0.00	0.04			5
			7958						0015	1		5	001.176	00.16	00.06	00.49	00.72	0.00	0.04			5
			7960						0015	4		5	000.670	00.16	00.06	00.49	00.72	0.00	0.04			5
			7961						0015	4		5	000.551	00.16	00.06	00.49	00.72	0.00	0.04			5
			7962						0027	1*		5	000.003-	00.10	00.03	00.57	00.71	0.01-	0.05			5
			7963						0027	1		5	000.001	00.10	00.03	00.57	00.71	0.01-	0.05			5
			7965						0027	4		5	000.661	00.10	00.03	00.57	00.71	0.01-	0.05			5
			7966						0027	4		5	000.633	00.10	00.03	00.57	00.71	0.01-	0.05			5
		1402	7973	12		4131N	16031W		0000	2		5	000.138	00.05	00.04	00.57	00.66	0.04-	0.06			5
			7973						0000	1		5	000.138	00.05	00.04	00.57	00.66	0.04-	0.06			5
			7974						0000	2		5	000.095	00.05	00.04	00.57	00.66	0.04-	0.06			5
			7974						0000	1		5	000.095	00.05	00.04	00.57	00.66	0.04-	0.06			5
			7976						0002	1		5	000.119	00.10	00.06	00.54	00.70	0.04-	0.06			5
			7977						0002	1		5	000.127	00.10	00.06	00.54	00.70	0.04-	0.06			5
			7979						0002	2		5	000.221	00.10	00.06	00.54	00.70	0.04-	0.06			5
			7980						0002	2		5	000.233	00.10	00.06	00.54	00.70	0.04-	0.06			5
			7981						0012	1		5	000.018	00.02	00.00	00.34	00.36	0.01-	0.02			5
			7982						0012	1		5	000.019	00.02	00.00	00.34	00.36	0.01-	0.02			5
			7984						0012	2		5	000.149	00.02	00.00	00.34	00.36	0.01-	0.02			5
			7985						0012	2		5	000.164	00.02	00.00	00.34	00.36	0.01-	0.02			5
			7986						0027	1		5	000.038	00.12	00.08	00.34	00.54	0.01-	0.04			5
			7987						0027	1		5	000.030	00.12	00.08	00.34	00.54	0.01-	0.04			5
			7989						0027	2		5	000.197	00.12	00.08	00.34	00.54	0.01-	0.04			5
			7990						0027	2		5	000.569	00.12	00.08	00.34	00.54	0.01-	0.04			5
			7991						0052	1		5	000.003	00.05	00.04-	00.23	00.24	0.01-	0.00			5
			7992						0052	1		5	000.002	00.05	00.04-	00.23	00.24	0.01-	0.00			5
			7994						0052	2		5	000.093	00.05	00.04-	00.23	00.24	0.01-	0.00			5
			7995						0052	2		5	000.101	00.05	00.04-	00.23	00.24	0.01-	0.00			5
		1435	8005	06	05/10/61	4017N	16028W		0000	2		5	000.041	00.01	00.00	00.01-	00.00	0.01	0.00			5
			8005						0000	1		5	000.041	00.01	00.00	00.01-	00.00	0.01	0.00			5
			8006						0000	2		5	000.038	00.01	00.00	00.01-	00.00	0.01	0.00			5
			8006						0000	1		5	000.038	00.01	00.00	00.01-	00.00	0.01	0.00			5
			8008						0002	1		5	000.047	00.02	00.01	00.32	00.35	0.04-	0.03			5
			8009						0002	1		5	000.064	00.02	00.01	00.32	00.35	0.04-	0.03			5
			8011						0002	2		5	000.084	00.02	00.01	00.32	00.35	0.04-	0.03			5
			8012						0002	2		5	000.079	00.02	00.01	00.32	00.35	0.04-	0.03			5
			8013						0012	1		5	000.021	00.01	00.01	00.06	00.08	0.00	0.00			5
			8014						0012	1		5	000.017	00.01	00.01	00.06	00.08	0.00	0.00			5
			8016						0012	2		5	000.086	00.01	00.01	00.06	00.08	0.00	0.00			5
			8017						0012	2		5	000.092	00.01	00.01	00.06	00.08	0.00	0.00			5
			8018						0027	1		5	000.006	00.02	00.01	00.21	00.24	0.01	0.00			5
			8019						0027	1		5	000.010	00.02	00.01	00.21	00.24	0.01	0.00			5
			8021						0027	2		5	000.091	00.02	00.01	00.21	00.24	0.01	0.00			5
			8022						0027	2		5	000.089	00.02	00.01	00.21	00.24	0.01	0.00			5
			8023						0052	1		5	000.004	00.08	00.02	00.31	00.42	0.00	0.02			5
			8024						0052	1		5	000.004	00.08	00.02	00.31	00.42	0.00	0.02			5
			8026						0052	2*		5	000.004-	00.08	00.02	00.31	00.42	0.00	0.02			5
			8027						0052	2		5	000.214	00.08	00.02	00.31	00.42	0.00	0.02			5
		1450	8034	12		3917N	16024W	125	0000	1		5	000.018	00.02	00.04	00.35	00.40	0.05-	0.08			5
			8035						0000	1		5	000.017	00.02	00.04	00.35	00.40	0.05-	0.08			5
			8037						0000	3		5	000.044	00.02	00.04	00.35	00.40	0.05-	0.08			5

VE	CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1	2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR	
NO	66	1450	8038	12	05/10/61	3917N	16024W	125	0000	3		5	000.062	00.02	00.04	00.35	00.40	0.05-	0.08			NO66	5
			8039						0005	1		5	000.013	00.05	00.01	00.34	00.39	0.02-	0.05				5
			8040						0005	1		5	000.009	00.05	00.01	00.34	00.39	0.02-	0.05				5
			8042						0005	3		5	000.024	00.05	00.01	00.34	00.39	0.02-	0.05				5
			8043						0005	3		5	000.025	00.05	00.01	00.34	00.39	0.02-	0.05				5
			8044						0022	1		5	000.003	00.01	00.01	00.07	00.10	0.02-	0.02				5
			8045						0022	1*		5	000.002-	00.01	00.01	00.07	00.10	0.02-	0.02				5
			8047						0022	3		5	000.008	00.01	00.01	00.07	00.10	0.02-	0.02				5
			8048						0022	3		5	000.013	00.01	00.01	00.07	00.10	0.02-	0.02				5
			8049						0050	1		5	000.009	00.16	00.13	00.84	01.13	0.00	0.12				5
			8050						0050	1		5	000.003	00.16	00.13	00.84	01.13	0.00	0.12				5
			8052						0050	3		5	000.034	00.16	00.13	00.84	01.13	0.00	0.12				5
			8053						0050	3		5	000.046	00.16	00.13	00.84	01.13	0.00	0.12				5
			8054						0089	1*		5	000.012-	00.00	00.00	00.00	00.00	0.00	0.00				5
			8055						0089	1*		5	000.016-	00.00	00.00	00.00	00.00	0.00	0.00				5
			8057						0089	3*		5	000.016-	00.00	00.00	00.00	00.00	0.00	0.00				5
			8058						0089	3*		5	000.018-	00.00	00.00	00.00	00.00	0.00	0.00				5
		1489	8068	06	06/10/61	3812N	16022W		0000	1		5	000.090	00.01	00.00	00.06	00.07	0.01-	0.02				5
			8069						0000	1		5	000.086	00.01	00.00	00.06	00.07	0.01-	0.02				5
			8071						0000	3		5	000.101	00.01	00.00	00.06	00.07	0.01-	0.02				5
			8072						0000	3		5	000.106	00.01	00.00	00.06	00.07	0.01-	0.02				5
			8073						0005	1		5	000.034	00.07	00.02-	00.77	00.82	0.05-	0.06				5
			8074						0005	1		5	000.051	00.07	00.02-	00.77	00.82	0.05-	0.06				5
			8076						0005	3		5	000.130	00.07	00.02-	00.77	00.82	0.05-	0.06				5
			8077						0005	3		5	000.140	00.07	00.02-	00.77	00.82	0.05-	0.06				5
			8078	07					0022	1		5	000.018	00.04	00.04	00.39	00.46	0.05-	0.06				5
			8079						0022	1		5	000.020	00.04	00.04	00.39	00.46	0.05-	0.06				5
			8081						0022	3		5	000.085	00.04	00.04	00.39	00.46	0.05-	0.06				5
			8082						0022	3		5	000.079	00.04	00.04	00.39	00.46	0.05-	0.06				5
			8083						0050	1		5	000.010	00.07	00.06	00.46	00.59	0.07-	0.08				5
			8084						0050	1		5	000.017	00.07	00.06	00.46	00.59	0.07-	0.08				5
			8086						0050	3		5	000.052	00.07	00.06	00.46	00.59	0.07-	0.08				5
			8087						0050	3		5	000.034	00.07	00.06	00.46	00.59	0.07-	0.08				5
		1502	8094	12		3728N	16018W		0000	1		5	000.047	00.02	00.01-	00.25	00.25	0.06-	0.05				5
			8095						0000	1		5	000.045	00.02	00.01-	00.25	00.25	0.06-	0.05				5
			8097						0000	4		5	000.055	00.02	00.01-	00.25	00.25	0.06-	0.05				5
			8098						0000	4		5	000.056	00.02	00.01-	00.25	00.25	0.06-	0.05				5
			8099						0004	1		5	000.038	00.01	00.00	00.12	00.13	0.04-	0.03				5
			8100						0004	1		5	000.041	00.01	00.00	00.12	00.13	0.04-	0.03				5
			8102						0004	4		5	000.086	00.01	00.00	00.12	00.13	0.04-	0.03				5
			8103						0004	4		5	000.085	00.01	00.00	00.12	00.13	0.04-	0.03				5
			8104						0038	1		5	000.006	00.04	00.02-	00.53	00.55	0.04-	0.04				5
			8105						0038	1		5	000.010	00.04	00.02-	00.53	00.55	0.04-	0.04				5
			8107						0038	4		5	000.064	00.04	00.02-	00.53	00.55	0.04-	0.04				5
			8108						0038	4		5	000.066	00.04	00.02-	00.53	00.55	0.04-	0.04				5
			8109						0060	1		5	000.009	00.11	00.03	00.34	00.49	0.02	0.02				5
			8110						0060	1		5	000.013	00.11	00.03	00.34	00.49	0.02	0.02				5
			8112						0060	4		5	000.003	00.11	00.03	00.34	00.49	0.02	0.02				5
			8113						0060	4		5	000.006	00.11	00.03	00.34	00.49	0.02	0.02				5
			8114						0080	1*		5	000.017-	00.13	00.09	00.34	00.56	0.04-	0.07				5
			8115						0080	1*		5	000.016-	00.13	00.09	00.34	00.56	0.04-	0.07				5
			8117						0080	4*		5	000.010-	00.13	00.09	00.34	00.56	0.04-	0.07				5

VE CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1 2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR
NO 66	1502	8118	12	06/10/61	3728N	16018W	125	0080	4*	5	000.019-	00.13	00.09	00.34	00.56	0.04-	0.07			N066 5
	1530	8128	06	07/10/61	3635N	16017W		0000	1*	5	000.006-	00.05	00.02-	00.43	00.46	0.06-	0.06			5
		8129						0000	1*	5	000.004-	00.05	00.02-	00.43	00.46	0.06-	0.06			5
		8131						0000	4	5	000.038	00.05	00.02-	00.43	00.46	0.06-	0.06			5
		8132						0000	4	5	000.037	00.05	00.02-	00.43	00.46	0.06-	0.06			5
		8133						0004	1	5	000.014	00.00	00.00	00.00	00.00	0.00	0.00			5
		8134						0004	1	5	000.006	00.00	00.00	00.00	00.00	0.00	0.00			5
		8136						0004	4	5	000.067	00.00	00.00	00.00	00.00	0.00	0.00			5
		8137						0004	4	5	000.063	00.00	00.00	00.00	00.00	0.00	0.00			5
		8138						0038	1	5	000.004	00.04	00.04-	00.36	00.36	0.03-	0.03			5
		8139						0038	1	5	000.007	00.04	00.04-	00.36	00.36	0.03-	0.03			5
		8141						0038	4	5	000.049	00.04	00.04-	00.36	00.36	0.03-	0.03			5
		8142						0038	4	5	000.052	00.04	00.04-	00.36	00.36	0.03-	0.03			5
		8143						0060	1	5	000.008	00.05	00.02	00.52	00.60	0.04-	0.06			5
		8144						0060	1	5	000.007	00.05	00.02	00.52	00.60	0.04-	0.06			5
		8146						0060	4	5	000.060	00.05	00.02	00.52	00.60	0.04-	0.06			5
		8147						0060	4	5	000.072	00.05	00.02	00.52	00.60	0.04-	0.06			5
		8148						0080	1	5	000.000	00.02	00.03-	00.21	00.21	0.05-	0.04			5
		8149						0080	1	5	000.001	00.02	00.03-	00.21	00.21	0.05-	0.04			5
		8151						0080	4	5	000.030	00.02	00.03-	00.21	00.21	0.05-	0.04			5
		8152						0080	4	5	000.028	00.02	00.03-	00.21	00.21	0.05-	0.04			5
	1576	8162		08/10/61	3401N	16013W		0000	2	5	000.051	00.07	00.02-	00.49	00.54	0.03-	0.04			5
		8162						0000	1	5	000.051	00.07	00.02-	00.49	00.54	0.03-	0.04			5
		8163						0000	2	5	000.048	00.07	00.02-	00.49	00.54	0.03-	0.04			5
		8163						0000	1	5	000.048	00.07	00.02-	00.49	00.54	0.03-	0.04			5
		8165						0004	1	5	000.039	00.00	00.00	00.00	00.00	0.03-	0.02			5
		8166						0004	1	5	000.035	00.00	00.00	00.00	00.00	0.03-	0.02			5
		8168						0004	2	5	000.075	00.00	00.00	00.00	00.00	0.03-	0.02			5
		8169						0004	2	5	000.071	00.00	00.00	00.00	00.00	0.03-	0.02			5
		8170						0038	1	5	000.013	00.02	00.04	00.26	00.33	0.07-	0.08			5
		8171						0038	1	5	000.017	00.02	00.04	00.26	00.33	0.07-	0.08			5
		8173						0038	2	5	000.102	00.02	00.04	00.26	00.33	0.07-	0.08			5
		8174						0038	2	5	000.121	00.02	00.04	00.26	00.33	0.07-	0.08			5
		8175						0060	1	5	000.016	00.05	00.03	00.35	00.43	0.07-	0.08			5
		8176						0060	1	5	000.012	00.05	00.03	00.35	00.43	0.07-	0.08			5
		8178						0060	2	5	000.090	00.05	00.03	00.35	00.43	0.07-	0.08			5
		8179						0060	2	5	000.087	00.05	00.03	00.35	00.43	0.07-	0.08			5
		8180						0080	1*	5	000.040-	00.12	00.01	00.72	00.85	0.06-	0.07			5
		8181						0080	1*	5	000.042-	00.12	00.01	00.72	00.85	0.06-	0.07			5
		8183						0080	2	5	000.074	00.12	00.01	00.72	00.85	0.06-	0.07			5
		8184						0080	2	5	000.075	00.12	00.01	00.72	00.85	0.06-	0.07			5
	1590	8191	13		3241N	16010W		0000	2	5	000.031	00.03	00.02-	00.34	00.35	0.09-	0.08			5
		8191						0000	1	5	000.031	00.03	00.02-	00.34	00.35	0.09-	0.08			5
		8192						0000	2	5	000.029	00.03	00.02-	00.34	00.35	0.09-	0.08			5
		8192						0000	1	5	000.029	00.03	00.02-	00.34	00.35	0.09-	0.08			5
		8194						0004	1*	5	000.010-	00.00	00.01-	00.14	00.13	0.07-	0.06			5
		8195						0004	1	5	000.037	00.00	00.01-	00.14	00.13	0.07-	0.06			5
		8197						0004	2	5	000.051	00.00	00.01-	00.14	00.13	0.07-	0.06			5
		8198						0004	2	5	000.043	00.00	00.01-	00.14	00.13	0.07-	0.06			5
		8199						0032	1	5	000.014	00.02	00.02	00.04	00.08	0.07-	0.07			5
		8200						0032	1	5	000.014	00.02	00.02	00.04	00.08	0.07-	0.07			5
		8202						0032	2	5	000.075	00.02	00.02	00.04	00.08	0.07-	0.07			5

VE	CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1	2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR
NO	66	1590	8203	13	08/10/61	3241N	16010W	125	0032	2		5	000.075	00.02	00.02	00.04	00.08	0.07-	0.07			NO66 5
			8204						0050	1		5	000.001	00.01	00.01-	00.04	00.04	0.03-	0.02			5
			8205						0050	1		5	000.005	00.01	00.01-	00.04	00.04	0.03-	0.02			5
			8207						0050	2		5	000.082	00.01	00.01-	00.04	00.04	0.03-	0.02			5
			8208						0050	2		5	000.104	00.01	00.01-	00.04	00.04	0.03-	0.02			5
			8209						0081	1*		5	000.005-	00.07	00.03	00.52	00.62	0.04-	0.07			5
			8210						0081	1		5	000.000	00.07	00.03	00.52	00.62	0.04-	0.07			5
			8212						0081	2		5	000.083	00.07	00.03	00.52	00.62	0.04-	0.07			5
			8213						0081	2		5	000.092	00.07	00.03	00.52	00.62	0.04-	0.07			5
		1618	8223	06	09/10/61	3016N	16006W		0000	2		5	000.082	00.02	00.05-	00.55	00.52	0.09-	0.10			5
			8223						0000	1		5	000.082	00.02	00.05-	00.55	00.52	0.09-	0.10			5
			8224						0000	2		5	000.060	00.02	00.05-	00.55	00.52	0.09-	0.10			5
			8224						0000	1		5	000.060	00.02	00.05-	00.55	00.52	0.09-	0.10			5
			8226						0004	1		5	000.061	00.00	00.00	00.00	00.00	0.02	0.00			5
			8227						0004	1		5	000.059	00.00	00.00	00.00	00.00	0.02	0.00			5
			8229						0004	2		5	000.090	00.00	00.00	00.00	00.00	0.02	0.00			5
			8230						0004	2		5	000.054	00.00	00.00	00.00	00.00	0.02	0.00			5
			8231						0032	1		5	000.030	00.03	00.05-	00.60	00.58	0.06-	0.09			5
			8232						0032	1		5	000.021	00.03	00.05-	00.60	00.58	0.06-	0.09			5
			8234						0032	2		5	000.092	00.03	00.05-	00.60	00.58	0.06-	0.09			5
			8235						0032	2		5	000.091	00.03	00.05-	00.60	00.58	0.06-	0.09			5
			8236						0050	1		5	000.002	00.00	00.01	00.11	00.12	0.06-	0.08			5
			8237						0050	1		5	000.004	00.00	00.01	00.11	00.12	0.06-	0.08			5
			8239						0050	2		5	000.115	00.00	00.01	00.11	00.12	0.06-	0.08			5
			8240						0050	2		5	000.080	00.00	00.01	00.11	00.12	0.06-	0.08			5
			8241						0081	1		5	000.002	00.05	00.05	00.30	00.40	0.09-	0.10			5
			8242						0081	1		5	000.004	00.05	00.05	00.30	00.40	0.09-	0.10			5
			8244						0081	2		5	000.067	00.05	00.05	00.30	00.40	0.09-	0.10			5
			8245						0081	2		5	000.079	00.05	00.05	00.30	00.40	0.09-	0.10			5
		1626	8276	12			16010W		0001	1		5	000.048	00.08	00.06	00.40	00.54	0.05-	0.08			5
			8277						0001	1		5	000.047	00.08	00.06	00.40	00.54	0.05-	0.08			5
			8279						0001	3		5	000.033	00.08	00.06	00.40	00.54	0.05-	0.08			5
			8280						0001	3		5	000.040	00.08	00.06	00.40	00.54	0.05-	0.08			5
			8281						0003	1		5	000.073	00.05	00.04	00.33	00.42	0.04	0.01-			5
			8282						0003	1		5	000.036	00.05	00.04	00.33	00.42	0.04	0.01-			5
			8284						0003	3		5	000.075	00.05	00.04	00.33	00.42	0.04	0.01-			5
			8285						0003	3		5	000.194	00.05	00.04	00.33	00.42	0.04	0.01-			5
			8286						0035	1		5	000.016	00.07	00.03	00.68	00.78	0.05-	0.07			5
			8287						0035	1		5	000.015	00.07	00.03	00.68	00.78	0.05-	0.07			5
			8289						0035	3		5	000.072	00.07	00.03	00.68	00.78	0.05-	0.07			5
			8290						0035	3		5	000.047	00.07	00.03	00.68	00.78	0.05-	0.07			5
			8291						0063	1		5	000.004	00.03	00.04	00.38	00.44	0.04-	0.05			5
			8292						0063	1		5	000.006	00.03	00.04	00.38	00.44	0.04-	0.05			5
			8294						0063	3		5	000.040	00.03	00.04	00.38	00.44	0.04-	0.05			5
			8295						0063	3		5	000.028	00.03	00.04	00.38	00.44	0.04-	0.05			5
			8296						0102	1*		5	000.007-	00.06	00.03	00.49	00.58	0.03-	0.07			5
			8297						0102	1		5	000.002	00.06	00.03	00.49	00.58	0.03-	0.07			5
			8299						0102	3		5	000.009	00.06	00.03	00.49	00.58	0.03-	0.07			5
			8300						0102	3		5	000.012	00.06	00.03	00.49	00.58	0.03-	0.07			5
		1655	8316	07	10/10/61	2802N	16014W	089	0001	1		5	000.055	00.15	00.15-	01.08	01.07	0.06-	0.11			5
			8317						0001	1		5	000.057	00.15	00.15-	01.08	01.07	0.06-	0.11			5
			8319						0001	3		5	000.066	00.15	00.15-	01.08	01.07	0.06-	0.11			5

VE	CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1	2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR
NO	66	1655	8320	07	10/10/61	2802N	16014W	089	0001	3		5	000.049	00.15	00.15-	01.08	01.07	0.06-	0.11			NO66 5
			8321						0003	1		5	000.038	00.07	00.01	00.46	00.55	0.05-	0.07			5
			8322						0003	1		5	000.043	00.07	00.01	00.46	00.55	0.05-	0.07			5
			8324						0003	3		5	000.047	00.07	00.01	00.46	00.55	0.05-	0.07			5
			8325						0003	3		5	000.064	00.07	00.01	00.46	00.55	0.05-	0.07			5
			8326						0035	1		5	000.022	00.03	00.00	00.44	00.47	0.05-	0.07			5
			8327						0035	1		5	000.025	00.03	00.00	00.44	00.47	0.05-	0.07			5
			8329						0035	3		5	000.068	00.03	00.00	00.44	00.47	0.05-	0.07			5
			8330						0035	3		5	000.067	00.03	00.00	00.44	00.47	0.05-	0.07			5
			8331						0063	1		5	000.016	00.14	00.10	00.97	01.20	0.08-	0.16			5
			8332						0063	1		5	000.014	00.14	00.10	00.97	01.20	0.08-	0.16			5
			8334						0063	3		5	000.074	00.14	00.10	00.97	01.20	0.08-	0.16			5
			8335						0063	3		5	000.068	00.14	00.10	00.97	01.20	0.08-	0.16			5
			8336						0102	1		5	000.000	00.04	00.03	00.55	00.63	0.01-	0.05			5
			8337						0102	1		5	000.000	00.04	00.03	00.55	00.63	0.01-	0.05			5
			8339						0102	3		5	000.008	00.04	00.03	00.55	00.63	0.01-	0.05			5
			8340						0102	3		5	000.002	00.04	00.03	00.55	00.63	0.01-	0.05			5
		1670	8347	13		2711N	16000W		0000	1		5	000.034	00.04	00.07	00.40	00.50	0.05-	0.07			5
			8348						0000	1		5	000.035	00.04	00.07	00.40	00.50	0.05-	0.07			5
			8350						0000	4		5	000.040	00.04	00.07	00.40	00.50	0.05-	0.07			5
			8351						0000	4		5	000.055	00.04	00.07	00.40	00.50	0.05-	0.07			5
			8352						0003	1		5	000.029	00.06	00.06	00.59	00.72	0.06-	0.11			5
			8353						0003	1		5	000.027	00.06	00.06	00.59	00.72	0.06-	0.11			5
			8355						0003	4		5	000.049	00.06	00.06	00.59	00.72	0.06-	0.11			5
			8356						0003	4		5	000.047	00.06	00.06	00.59	00.72	0.06-	0.11			5
			8357						0035	1		5	000.018	00.10	00.07	00.70	00.87	0.10-	0.16			5
			8358						0035	1		5	000.017	00.10	00.07	00.70	00.87	0.10-	0.16			5
			8360						0035	4		5	000.068	00.10	00.07	00.70	00.87	0.10-	0.16			5
			8361						0035	4		5	002.267	00.10	00.07	00.70	00.87	0.10-	0.16			5
			8362						0063	1		5	000.002	00.07	00.05	00.49	00.60	0.01-	0.06			5
			8363						0063	1		5	000.007	00.07	00.05	00.49	00.60	0.01-	0.06			5
			8365						0063	4		5	000.016	00.07	00.05	00.49	00.60	0.01-	0.06			5
			8366						0063	4		5	000.005	00.07	00.05	00.49	00.60	0.01-	0.06			5
			8367						0102	1		5	000.001	00.10	00.06	00.84	01.00	0.03-	0.08			5
			8368						0102	1*		5	000.002-	00.10	00.06	00.84	01.00	0.03-	0.08			5
			8370						0102	4		5	000.002	00.10	00.06	00.84	01.00	0.03-	0.08			5
			8371						0102	4		5	000.003	00.10	00.06	00.84	01.00	0.03-	0.08			5
		1704	8381	06	11/10/61	2512N	15958W	088	0000	1		5	000.122	00.04	00.07-	00.52	00.49	0.02-	0.05			5
			8382						0000	1		5	000.071	00.04	00.07-	00.52	00.49	0.02-	0.05			5
			8384						0000	4		5	000.077	00.04	00.07-	00.52	00.49	0.02-	0.05			5
			8385						0000	4		5	000.068	00.04	00.07-	00.52	00.49	0.02-	0.05			5
			8386						0003	1		5	000.071	00.02	00.05	00.43	00.50	0.00	0.04			5
			8387						0003	1		5	000.062	00.02	00.05	00.43	00.50	0.00	0.04			5
			8389						0003	4		5	000.101	00.02	00.05	00.43	00.50	0.00	0.04			5
			8390						0003	4		5	000.099	00.02	00.05	00.43	00.50	0.00	0.04			5
			8391						0035	1		5	000.017	00.02	00.04	00.31	00.37	0.00	0.04			5
			8392						0035	1		5	000.019	00.02	00.04	00.31	00.37	0.00	0.04			5
			8394						0035	4		5	000.082	00.02	00.04	00.31	00.37	0.00	0.04			5
			8395						0035	4		5	000.093	00.02	00.04	00.31	00.37	0.00	0.04			5
			8396						0063	1		5	000.007	00.14	00.08	00.87	01.09	0.08-	0.13			5
			8397						0063	1		5	000.020	00.14	00.08	00.87	01.09	0.08-	0.13			5
			8399						0063	4		5	000.069	00.14	00.08	00.87	01.09	0.08-	0.13			5

VE	CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1	2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR	
NO	66	1704	8400	06	11/10/61	2512N	15958W	088	0063	4		5	000.068	00.14	00.08	00.87	01.09	0.08-	0.13			NO66	5
			8401						0102	1		5	000.012	00.11	00.07	00.85	01.04	0.04-	0.08				5
			8402						0102	1		5	000.473	00.11	00.07	00.85	01.04	0.04-	0.08				5
			8404						0102	4		5	000.040	00.11	00.07	00.85	01.04	0.04-	0.08				5
			8405						0102	4		5	000.039	00.11	00.07	00.85	01.04	0.04-	0.08				5
		1720	8412	22		2330N	16000W	089	0000	4*		5	000.004	00.03	00.03	00.18	00.25	0.03-	0.03				5
			8413						0000	4*		5	000.005	00.03	00.03	00.18	00.25	0.03-	0.03				5

Pioneer Zooplankton Investigations

Zooplankton investigations were conducted by Mr. Jerry D. Larrance of the Bureau of Commercial Fisheries, Biological Laboratory, Seattle, Washington.

His description of techniques and activities in connection with this work is as follows.

"Samples were collected at 31 oceanographic and 13 productivity stations. At each oceanographic station, one or two vertical tows were made with a $\frac{1}{2}$-meter, No. 6 mesh net from 150 meters depth to the surface. On some of the stations, extra wire was let out to compensate for the wire angle. The depths in Table II are computed from the wire out and the wire angle.

"Immediately following most of these stations, a stepped oblique MWT (modified three-foot Isaacs-Kidd midwater trawl) tow was made. The net was hauled from 200 meters depth to the surface while the ship was moving at three knots. At each 25-meter depth increment, the winch was stopped until five minutes had elapsed since the beginning of the haul from the previous depth increment, resulting in a total towing time of 45 minutes. Depths for the stepped MWT tows were computed from a previously determined wire out-depth ratio of 4-1.

"Plans were made to take horizontal MWT tows in the deep scattering layer south of 35° N. latitude, but the layer was not detected in that region, although easily evident north of 35° North. Ten horizontal tows were taken in, above, and below a salinity minimum layer (salinity less than 34.0 °/oo) found north of 35° N. Other tows were planned but not completed in this series.

"Thirteen of the productivity stations were followed by a 30-minute tow with four standard Clarke-Bumpus samplers with No. 6 mesh nylon nets on the wire at depths of 5, 15, 30, and 70 meters. All samplers were opened and closed at depth to avoid contaminating the samples with organisms at shallower depths.

"Mrs. Fay I. Linger completed settling volumes, and the identification and percentage composition of dominant groups for the zooplankton samples (Table II). The hauls were allowed to settle for at least 20 minutes in tapered graduates and the volumes were read in cubic centimeters. For the Clarke-Bumpus tows, the percentage of the haul contributed by the dominant group was estimated; the volumes were generally too small for measurement. For the $\frac{1}{2}$-meter and MWT tows, the volume of the dominant group was measured for those hauls exceeding 25 cc total volume, to determine the per cent of hauls. In a few cases, no group constituted a majority of the haul (20 per cent or more) as indicated in the tabulations.

"The $\frac{1}{2}$-meter tow at Station 41 yielded phytoplankton in quantity for the first time. A transition in faunal elements occurred between 41°25' and 43°35' (stations 35 and 37) on the north-bound leg along 177° W. longitude. Generally, the total volumes increased and the dominant organisms, usually copepods, chaetognaths, and euphausids, were larger and less diverse. The barnacle naupli were no longer found.

"On the south-bound leg along 160° W. longitude, the transition to southern forms occurred near 44° N. latitude for the Clarke-Bumpus, 45° N. for the $\frac{1}{2}$-meter, and 40° N. for the MWT tows. The $\frac{1}{2}$-meter hauls were definitely northern at Station 51, and mixed at Station 52, with slightly more northern forms. The C-B samples at Station 53 were primarily southern. At Station 54, the MWT hauls were mixed with more northern forms but definitely southern forms at Station 56."

Table II. Zooplankton samples, Pioneer, 1961

Station	Position Latitude N.	Position Longitude W.	Date	Time G.M.T.	Type of Tow 2/	Computed depth M. 3/	Volume cc 4/	Dominant Group 5/	Percent Haul 6/
21	23°28'	161°53'	9/9	03:00	V	150-0	5	copepods crustacean larvae	
			9	08:17	H	120	50	euphausids	30
22	24°36'	166°21'	10	03:55	V	164-0	5	copepods crustacean larvae	
			10	07:25	SO	200-0	60	fish larvae	25
23	23°56'	167°24'	10	19:42	V	150-0	5	copepods	50
			10	21:35	SO	200-0	15	---------7/	
24	23°29'	172°26'	11	21:30	V	150-0	5	copepods	50
			11	23:30	SO	200-0	10	---------	
25	23°22'	177°35'	13	01:05	V	150-0	10	copepods	50
			13	05:05	SO	200-0	25	chaetognaths	20
26	25°53'	177°33'	14	00:23	V	115-0	5	copepods	50
			14	00:35	V	115-0	5	copepods	50
			14	01:45	SO	200-0	20	chaetognaths	25
27	30°11'	177°33'	15	17:57	SO	200-0	20	---------	
28 1/	31°20'	177°22'	16	00:22	CB	3	<5	copepods	90
29	32°25'	177°14'	16	12:06	V	123-0	10	copepods	70
			16	13:20	SO	200-0	80	euphausids	40
31	34°38'	177°10'	17	02:34	V	115-0	10	barnacle nauplii	80
			17	02:50	V	115-0	10	barnacle nauplii	80
			17	04:02	SO	200-0	30	barnacle nauplii	30
32	36°49'	177°33'	17	18:55	V	75-0	5	copepods	50
			17	19:15	V	75-0	5	barnacle nauplii	80
			18	03:52	SO	200-0	25	---------	

1/ Productivity stations. All others are regular oceanographic stations.

2/ V: Vertical ½-meter haul; H: Horizontal MWT tow; SO: Stepped oblique: CB: Clarke-Bumpus tow.

3/ Depths computed from wire out and wire angle. Depths for the stepped midwater trawl hauls were computed from a wire out-depth ratio of 4 - 1.

4/ Settled volumes of the total haul given in cubic centimeters.

5/ The major group of animals in each haul, constituting 20 per cent or more of the total volume of the haul.

6/ The approximate percentage, by volume, of the dominant group when it constituted 20 per cent or more of the total volume of the haul.

7/ --------- indicates no single group as dominant.

Station	Position Latitude N.	Longitude W.	Date	Time G.M.T.	Type of tow 2/	Computed depth M.3/	Volume cc.4/	Dominant Group 5/	Per cent haul 6/
33	39°01'	177°06'	9/19	11:18	V	130-0	10	barnacle naupli	80
			19	12:21	SO	200-0	150	euphausids	60
34 1/	40°38	177°03'	20	00:21	CB	3	<5	salps	
						8	5	veligers	
						15	<5	---------	
						35	<5	---------	
35	41°25'	177°00'	20	11:37	V	140-0	25	barnacle naupli	30
								veligers	30
								copepods	20
			20	11:50	V	140-0	25	barnacle naupli	30
								veligers	30
								copepods	20
			20	12:31	SO	200-0	225	barnacle naupli	40
								euphausids	20
37	43°35'	176°54'	21	05:28	V	150-0	5	copepods	
			21	05:55	H	150	225	euphausids	45
			21	07:30	H	450	200	euphausids	60
38	45°46'	176°34'	22	10:05	V	130-0	15	copepods	30
								euphausids	30
			22	11:16	H	400	325	copepods	30
								chaetognaths	20
			22	12:53	SO	200-0	225	chaetognaths	40
								euphausids	30
40	48°01'	176°25'	23	04:20	V	150-0	25	copepods	40
								pteropods	20
			23	05:33	H	400	325	euphausids	25
								copepods	25
								chaetognaths	25
			23	07:17	SO	200-0	300	copepods	33
								euphausids	25
								chaetognaths	25

Station	Position Latitude N.	Position Longitude W.	Date	Time G.M.T.	Type of tow 2/	Computed depth M.3/	Volume cc.4/	Dominant Group 5/	Percent haul 6/
41	50°28'	176°30'	9/23	23:22	V	138-0	100	copepods	60
			24	01:14	H	400	350	euphausids chaetognaths	35 20
			24	02:55	SO	200-0	150	euphausids	30
42	51°32'	168°40'	27	20:55	V	135-0	20	pteropods	40
			27	21:12	V	145-0	20	pteropods	40
			27	22:39	SO	200-0	75	chaetognaths	80
43 1/	51°50'	162°58'	28	17:46	CB	4	< 5	copepods	
						22	< 5	pteropods	
						37	< 5	copepods	
						74	5	copepods	
44 1/	52°33'	162°02'	28	23:13	CB	3	20	copepods	90
						8	30	copepods	90
						16	--		
						41	15	copepods	80
45	53°14'	161°33'	29	05:22	V	40-0	120	copepods	80
			29	07:45	H	300	200	euphausids chaetognaths	37 25
			29	08:10	SO	200-0	200	euphausids copepods	50 15
46 1/	53°39'	161°18'	29	17:15	CB	5	5	copepods	80
						15	10	copepods	80
						31	< 5	copepods	
						69	< 5	copepods	
47 1/	52°41'	162°11'	29	23:20	CB	5	25	copepods	90
						15	20	copepods	80
						30	< 5	----------	
						72	< 5	----------	

Station	Position Latitude N.	Longitude W.	Date	Time G.M.T.	Type of tow 2/	Computed depth M. 3/	Volume cc. 4/	Dominant Group 5/	Per cent haul 6/
48	51°41'	161°07'	9/30	06:33	V	145-0	40	copepods	50
49	49°53'	160°43'	10/1	02:17	V	153-0	20	copepods	60
			1	02:34	V	153-0	20	copepods	60
50	49°15'	160°40'	1	17:45	V	190-0	40	copepods	40
								chaetognaths	40
			1	18:06	V	190-0	40	copepods	40
								chaetognaths	40
51	46°06'	160°22'	2	16:27	V	153-0	25	copepods	40
			2	16:46	V	153-0	55	copepods	90
52	43°47'	160°35'	3	23:22	V	157-0	<5	copepods	
			3	23:37	V	150-0	<5	copepods	
			4	08:14	H	320	275	copepods	80
			4	09:55	SO	200-0	450	copepods	95
53 1/	42°18'	160°31'	4	17:22	CB	5	5	----------	
						15	5	----------	
						30	--		
						64	10	----------	
54	41°31'	160°27'	5	01:48	V	150-0	15	copepods	60
			5	02:00	V	150-0	15	copepods	60
			5	08:00	H	325	125	euphausids	50
			5	09:40	SO	200-0	100	euphausids	50
55 1/	40°13'	160°27'	5	17:35	CB	5	<5	copepods	
						15	<5	euphausids	
						30	<5	salps	
						72	5	euphausids	

Station	Position Latitude N.	Longitude W.	Date	Time G.M.T.	Type of tow[2]	Computed depth M.[3]	Volume cc.[4]	Dominant Group [5]	Percent haul[6]
56	39°15'	160°24'	10/6	01:58	V	150-0	15	salps	
			6	02:15	V	150-0	15	salps	
			6	09:15	H	525	200	euphausids	75
			6	11:26	SO	200-0	175	euphausids	60
57[1]	38°11'	160°23'	6	17:29	CB	10	<5	veligers	
						30	<5	veligers	
						72	<5	pteropods	
58[1]	37°26'	160°18'	6	23:17	CB	5	<5	veligers	
						15	<5	veligers	
						30	<5	---------	
						72	<5	---------	
59	37°01'	160°29'	7	11:28	SO	200-0	50	euphausids	50
61	34°50'	160°14'	8	04:24	V	115-0	5	copepods	
			8	04:37	V	115-0	10	copepods	
			8	09:35	H	600	75	euphausids	40
			8	11:47	SO	200-0	50	euphausids	60
62[1]	33°58'	160°13'	8	17:10	CB	5	5	copepods	
						15	<5	copepods	
						30	<5	---------	
						72	<5	---------	
64	30°16'	160°10'	9	21:17	V	156-0	5	copepods	
			9	21:30	V	156-0	5	copepods	

Station	Position Latitude N.	Longitude W.	Date	Time G.M.T.	Type of tow 2/	Computed depth M. 3/	Volume cc. 4/	Dominant Group 5/	Per cent haul 6/
65	28°02'	160°18'	10/10	15:17	V	154-0	10	copepods	
			10	15:31	V	154-0	10	copepods	
			10	16:14	SO	200-0	20	chaetognaths	50
66 1/	27°10'	160°01'	11	00:11	CB	5	<5	copepods	
						15	<5	copepods	
						30	<5	---------	
						65	<5	---------	
67	25°44'	160°05'	11	11:14	V	148-0	10	copepods	60
			11	11:32	V	148-0	10	copepods	60
			11	12:33	SO	200-0	50	euphausids	20
								copepods	20
								chaetognaths	20
68 1/	25°10'	159°58'	11	17:20	CB	5	<5	---------	
						15	<5	---------	
						30	<5	---------	
69	23°30'	160°01'	12	10:31	V	150-0	10	copepods	50
			12	10:38	V	150-0	10	copepods	50
			12	11:19	SO	200-0	50	small fish	50

TABLE III. Hydrographic data from the Pioneer cruise (N066).

Station1/	Depth(m)	Salinity(°/oo)	O_2(ml/l)	Temp.(°C)
P022	0000	35.01	4.06	27.39
	0010	35.00	4.18	26.78
	0020	35.05	4.18	26.74
	0030	35.06	4.32	26.72
	0050	35.05	4.49	25.72
	0075	35.11	4.68	23.56
	0100	35.17	4.58	22.22
	0150	35.15	3.44	20.86
	0200	35.15	4.37	-----
P023	0000	35.23	4.36	27.02
	0010	35.23	4.59	26.97
	0020	35.26	4.39	26.45
	0030	35.25	4.47	26.09
	0050	35.18	4.84	23.66
	0075	35.16	4.95	21.16
	0100	35.08	4.76	19.76
	0150	34.91	4.45	18.73
	0200	34.78	3.62	16.58
P024	0000	35.21	4.57	26.94
	0010	35.22	4.63	26.90
	0020	35.23	4.55	26.89
	0030	35.24	4.49	26.91
	0050	35.19	4.82	26.19
	0075	35.22	5.01	22.83
	0100	35.18	4.95	21.00
	0150	35.00	4.50	18.39
	0200	34.75	4.60	16.33
P025	0000	35.28	4.55	27.76
	0010	35.27	4.68	27.68
	0020	35.27	4.60	27.56
	0030	35.29	4.47	27.56
	0050	35.26	5.14	24.70
	0075	35.27	5.27	22.82
	0100	35.24	5.20	21.12
	0150	35.09	4.85	19.17
	0200	34.86	4.88	17.24
P026	0000	35.30	4.62	27.79
	0010	35.30	4.62	27.77
	0020	35.30	4.59	27.75
	0030	35.30	4.57	27.77
	0050	35.26	5.10	26.08
	0075	35.29	5.23	23.49
	0100	35.26	5.04	21.90
	0150	35.16	4.81	19.95
	0200	34.99	4.72	18.38

Station[1]/	Depth(m)	Salinity(°/oo)	O_2(ml/l)	Temp.(°C)
P027	0000	35.28	4.48	27.19
	0010	35.29	4.58	27.20
	0020	35.28	4.48	27.08
	0030	35.34	4.61	26.80
	0050	35.06	4.83	21.96
	0075	34.88	5.62	17.94
	0100	34.78	5.45	16.69
	0150	34.69	5.15	15.55
	0200	34.64	5.11	14.94
P029	0000	34.86	4.73	25.78
	0010	34.86	4.80	25.77
	0020	34.87	4.55	25.73
	0030	34.86	5.29	25.74
	0050	34.73	6.17	17.85
	0075	34.67	5.75	15.77
	0100	34.64	5.23	15.11
	0150	34.55	5.14	14.11
	0200	34.48	5.06	13.34
P031	0000	34.42	4.72	23.08
	0010	34.45	4.91	23.14
	0020	34.49	4.77	22.67
	0030	34.44	5.21	21.33
	0050	34.53	5.30	14.09
	0075	34.45	5.24	12.97
	0100	34.38	5.27	12.33
	0150	34.33	5.36	-----
	0200	34.32	5.24	11.13
P032	0000	34.55	4.63	22.09
	0010	34.54	4.63	22.10
	0020	34.55	----	22.09
	0030	34.55	4.77	22.08
	0050	34.53	5.00	22.10
	0075	34.54	7.08	16.46
	0100	34.57	5.27	14.32
	0150	34.45	5.35	12.67
	0200	34.34	5.42	11.70
P033	0000	34.12	4.88	20.20
	0010	34.12	5.14	20.20
	0020	34.11	5.19	20.20
	0030	34.12	5.10	20.22
	0050	34.45	6.99	15.42
	0075	34.41	5.57	13.19
	0100	34.39	5.31	12.24
	0150	34.55	5.39	11.43
	0200	34.30	5.37	10.90

Station[1]	Depth(m)	Salinity(°/oo)	O_2(ml/l)	Temp.(°C)
P035	0000	33.67	5.45	17.54
	0010	33.66	----	17.57
	0020	33.66	5.49	17.56
	0030	33.69	----	17.55
	0050	34.10	6.35	12.44
	0075	34.12	5.00	10.70
	0100	34.23	5.31	10.54
	0150	34.16	----	9.77
	0200	34.04	4.47	8.82
P038	0000	32.53	5.91	12.88
	0010	32.53	6.05	12.87
	0020	32.54	5.64	12.86
	0030	32.55	5.82	12.86
	0050	33.19	6.84	6.50
	0075	33.18	6.78	5.34
	0100	33.43	6.55	5.29
	0150	33.56	6.53	5.56
	0200	33.53	6.38	5.26
P040	0000	32.62	6.56	9.87
	0010	32.62	6.53	9.85
	0020	32.64	6.64	9.53
	0030	32.65	6.62	9.45
	0050	32.83	6.84	6.70
	0075	33.03	7.20	3.36
	0100	33.06	7.17	3.16
	0150	33.08	7.11	2.92
	0200	33.18	6.52	2.60
P041	0000	32.70	6.75	7.86
	0010	32.70	6.23	7.82
	0020	32.72	6.38	7.82
	0030	32.76	6.04	7.46
	0050	32.92	6.35	6.00
	0075	33.05	5.36	4.48
	0100	33.19	4.96	4.10
	0150	33.66	2.79	4.25
	0200	33.88	1.58	4.00
P042	0000	-----	6.26	10.34
	0010	32.45	6.34	10.32
	0020	32.44	6.32	10.34
	0030	32.44	6.37	10.34
	0050	32.66	6.48	6.90
	0075	32.79	6.07	4.40
	0100	32.90	6.82	3.36
	0150	33.34	4.42	3.61
	0200	33.61	2.83	3.92

Station[1/]	Depth(m)	Salinity(°/oo)	O_2(ml/l)	Temp.(°C)
P045	0000	31.84	6.39	9.83
	0010	31.83	6.52	9.82
	0020	31.83	6.52	9.82
	0030	31.85	6.39	9.76
	0050	32.10	5.70	5.87
	0075	32.23	5.64	5.31
	0100	32.31	4.29	4.93
	0150	32.63	3.89	4.80
	0200	33.16	2.72	5.32
P048	0000	32.16	6.27	10.74
	0010	32.21	6.32	10.80
	0020	32.23	6.30	10.76
	0030	32.22	6.23	10.75
	0050	32.86	6.56	4.51
	0075	32.92	6.62	3.52
	0100	33.14	5.55	3.74
	0150	33.48	3.70	4.13
	0200	33.77	2.03	4.02
P049	0000	32.48	4.25	10.98
	0010	32.47	5.03	10.96
	0020	32.48	5.03	10.96
	0030	32.47	4.31	10.97
	0050	32.58	5.29	10.30
	0075	32.87	5.42	3.45
	0100	33.01	5.35	3.16
	0150	33.38	3.86	3.19
	0200	33.75	1.87	4.03
P050	0000	32.42	5.84	11.65
	0010	32.41	6.15	11.64
	0020	32.42	6.12	11.64
	0030	32.40	5.99	11.63
	0050	32.83	6.01	5.79
	0075	32.85	6.69	4.82
	0100	32.90	6.83	4.01
	0150	32.90	6.85	3.85
	0200	32.94	6.68	3.89
P052	0000	32.82	5.71	15.86
	0010	32.81	5.78	15.78
	0020	32.82	5.78	15.74
	0030	33.05	6.35	12.31
	0050	33.20	6.50	9.29
	0075	33.28	6.49	6.78
	0100	33.30	6.39	6.50
	0150	33.31	6.46	6.38
	0200	33.39	6.33	6.58

Station[1/]	Depth(m)	Salinity(°/oo)	O_2(ml/l)	Temp.(°C)
P054	0000	33.18	5.31	19.64
	0010	33.19	5.34	19.64
	0020	33.18	5.37	19.52
	0030	33.22	5.47	19.18
	0050	33.62	7.10	10.61
	0075	33.70	6.10	8.50
	0100	33.69	6.15	8.04
	0150	33.81	5.99	8.46
	0200	33.89	5.58	8.32
P056	0000	34.19	4.89	22.16
	0010	34.18	5.03	21.97
	0020	34.16	5.05	21.74
	0030	34.16	5.02	21.68
	0050	34.06	7.62	14.04
	0075	34.16	5.95	11.62
	0100	34.18	5.65	10.86
	0150	34.12	5.70	10.43
	0200	34.08	5.76	10.08
P059	0000	34.58	4.76	23.43
	0010	34.56	4.66	23.44
	0020	34.55	4.68	23.45
	0030	34.56	4.65	23.44
	0050	34.55	4.97	23.44
	0075	34.46	7.11	15.27
	0100	34.41	5.44	13.08
	0150	34.33	5.37	12.23
	0200	34.29	5.40	11.70
P061	0000	34.52	4.88	23.45
	0010	34.52	5.03	23.45
	0020	34.51	5.06	23.47
	0030	34.53	4.95	23.46
	0050	34.40	6.58	17.54
	0075	34.39	6.36	15.14
	0100	34.36	6.12	13.75
	0150	34.30	5.54	12.54
	0200	34.30	5.52	12.16
P063	0000	35.09	4.55	24.12
	0010	35.10	4.52	24.13
	0020	35.09	4.60	24.06
	0030	35.10	4.50	24.06
	0050	34.73	5.56	18.72
	0075	34.54	4.78	14.81
	0100	34.47	5.11	14.17
	0150	34.45	4.94	13.84
	0200	34.44	4.95	13.27

Station1/	Depth(m)	Salinity($^{o}/oo$)	O_2(ml/l)	Temp.(^{o}C)
P064	0000	35.30	4.80	24.92
	0010	35.30	4.86	24.92
	0020	35.29	4.86	24.91
	0030	35.29	4.80	24.94
	0050	35.29	4.85	24.80
	0075	34.85	5.78	19.60
	0100	34.68	5.86	16.66
	0150	34.50	5.15	14.53
	0200	34.38	5.07	13.15
P065	0000	35.24	4.73	25.10
	0010	35.23	4.80	25.10
	0020	35.26	4.78	25.08
	0030	35.26	4.75	25.12
	0050	35.26	4.82	25.11
	0075	35.26	4.85	24.79
	0100	35.29	4.85	25.02
	0150	34.93	5.38	18.28
	0200	34.79	4.80	16.70
P067	0000	35.36	4.80	25.56
	0010	35.33	4.72	25.54
	0020	35.33	4.77	25.52
	0030	35.34	4.77	25.56
	0050	35.32	4.73	25.53
	0075	35.18	5.43	22.30
	0100	35.10	5.41	19.57
	0150	34.92	5.17	17.62
	0200	34.73	4.96	16.08

1/ Station positions are shown in Table II.

The second cruise, aboard the U. S. S. Rehobeth, left Honolulu on November 13, 1961 and returned on December 12th. The shipboard work was conducted by Mr. Neil Shim under ONR Contract 2591(00) with the University of Hawaii. Figure 1 shows the area sampled in the Central Pacific.

The similarities of two productivity techniques employed are briefly described below, together with the code number which identifies them on the data tables for NO67(Table IV).

1. Water samples from five depths, surface meter and per cent light depths 64, 30, 16 and 1 as determined, if morning, at the previous noon or, if noon, at the time of sampling. These were held in a 1961-type fluorescent incubator with neutral density filters for the respective depths.

2. Water samples from the surface meter were incubated in a 1961-type fluorescent incubator with neutral density filters to simulate the depths of 64, 30, 16 and 1 per cent light penetration.

The 1961- incubator is described above with the information on cruise NO66.

TABLE IV. Productivity and pigment data, Rehoboth, 1961 (N067).

VE	CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1	2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR
NO	67	0000	0000	08	16/11/61	2014N	17530W	090	0000	1		5	000.069	00.02	00.00	00.34	00.36	0.00	0.03			N067 5
			0001						0000	1		5	000.096	00.02	00.00	00.34	00.36	0.00	0.03			5
		0001	0003	06	17/11/61	1959N	17959W	054	0000	1		5	000.090									5
			0004						0000	1		5	000.101									5
			0006						0015	1		5	000.031									5
			0007						0015	1		5	000.029									5
			0009						0035	1		5	000.025									5
			0010						0035	1		5	000.014									5
			0012						0060	1		5	000.013									5
			0013						0060	1		5	000.008									5
			0015						0090	1		5	000.019									5
			0016						0090	1		5	000.026									5
			0018						0000	2		5	000.074									5
			0019						0000	2		5	000.066									5
			0021						0000	2		5	000.046									5
			0022						0000	2		5	000.026									5
			0024						0000	2		5	000.050									5
			0025						0000	2		5	000.006									5
			0027						0000	2		5	000.014									5
			0028						0000	2		5	000.023									5
			0030	11		1956N	17957W		0000	1*		5	000.003-	00.03	00.05-	00.46	00.43	0.06-	0.05			5
			0031						0000	1		5	000.009	00.03	00.05-	00.46	00.43	0.06-	0.05			5
			0033						0016	1		5	000.038	00.06	00.05	00.30	00.41	0.05-	0.08			5
			0034						0016	1		5	000.042	00.06	00.05	00.30	00.41	0.05-	0.08			5
			0036						0024	1		5	000.007	00.05	00.03-	00.51	00.53	0.01-	0.04			5
			0037						0024	1		5	000.008	00.05	00.03-	00.51	00.53	0.01-	0.04			5
			0039						0030	1		5	000.004	00.02	00.06	00.33	00.41	0.00	0.02			5
			0040						0030	1		5	000.003	00.02	00.06	00.33	00.41	0.00	0.02			5
			0042						0040	1*		5	000.006-	00.03	00.03-	00.21	00.21	0.01-	0.02			5
			0043						0040	1*		5	000.007-	00.03	00.03-	00.21	00.21	0.01-	0.02			5
			0048						0000	2		5	000.087									5
			0049						0000	2		5	000.037									5
			0051						0000	2		5	000.020									5
			0052						0000	2		5	000.014									5
			0053						0000	2*		5	000.001-									5
			0054						0000	2		5	000.014									5
			0055						0000	2		5	000.005									5
			0056						0000	2*		5	000.002-									5
		0002	0057	06	18/11/61	1654N	17902E	055	0000	1		5	000.050	00.01	00.00	00.20	00.21	0.02	0.01-			5
			0058						0000	1		5	000.062	00.01	00.00	00.20	00.21	0.02	0.01-			5
			0060						0000	2	9*	5	000.055	00.01	00.01	00.02-	00.00	0.02	0.00			5
			0061						0000	2	9*	5	000.057	00.01	00.01	00.02-	00.00	0.02	0.00			5
			0063						0000	2		5	000.025									5
			0064						0000	2		5	000.025									5
			0066						0000	2		5	000.014									5
			0067						0000	2		5	000.012									5
			0069						0000	2		5	000.001									5
			0070						0000	2*		5	000.007-									5
			0072						0016	1		5	000.034	00.04	00.04	00.22	00.30	0.03-	0.04			5
			0073						0016	1		5	000.043	00.04	00.04	00.22	00.30	0.03-	0.04			5
			0075						0024	1		5	000.015	00.02	00.05	00.17	00.24	0.01-	0.03			5
			0076						0024	1		5	000.004	00.02	00.05	00.17	00.24	0.01-	0.03			5

VE	CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1	2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR
NO	67	0002	0078	06	18/11/61	1654N	17902E	055	0030	1		5	000.010	00.02	00.01-	00.14	00.16	0.02	0.00			N067 5
			0079						0030	1		5	000.008	00.02	00.01-	00.14	00.16	0.02	0.00			5
			0081						0040	1		5	000.002	00.04	00.04	00.23	00.31	0.00	0.04			5
			0082						0040	1*		5	000.002-	00.04	00.04	00.23	00.31	0.00	0.04			5
			0087	11			17903E		0000	2		5	000.018									5
			0088						0000	2		5	000.015									5
			0090						0000	2		5	000.002									5
			0091						0000	2		5	000.005									5
			0092						0000	2		5	000.000									5
			0093						0000	2		5	000.101									5
			0094						0000	2*		5	000.003-									5
			0095						0000	2*		5	000.007-									5
			0096						0000	1		5	000.021	00.04	00.01-	00.13	00.16	0.02	0.01			5
			0097						0000	1		5	000.014	00.04	00.01-	00.13	00.16	0.02	0.01			5
			0099	12					0004	1		5	000.012	00.05	00.01	00.44	00.49	0.04-	0.05			5
			0100						0004	1		5	000.021	00.05	00.01	00.44	00.49	0.04-	0.05			5
			0102						0024	1		5	000.012	00.02	00.02-	00.32	00.32	0.03-	0.03			5
			0103						0024	1		5	000.014	00.02	00.02-	00.32	00.32	0.03-	0.03			5
			0105						0060	1		5	000.000	00.00	00.05	00.27	00.32	0.03-	0.05			5
			0106						0060	1		5	000.006	00.00	00.05	00.27	00.32	0.03-	0.05			5
			0108						0102	1*		5	000.003-	00.08	00.07	00.33	00.48	0.00	0.03			5
			0109						0102	1*		5	000.006-	00.08	00.07	00.33	00.48	0.00	0.03			5
		0003	0111	06	19/11/61	1412N	17951W	054	0000	2	9*	5	000.047	00.00	00.01	00.01-	00.00	0.00	0.02			5
			0112						0000	2	9*	5	000.038	00.00	00.01	00.01-	00.00	0.00	0.02			5
			0114						0000	2		5	000.021									5
			0115						0000	2		5	000.030									5
			0117						0000	2*		5	000.042-									5
			0118						0000	2*		5	000.022-									5
			0120						0000	2		5	000.010									5
			0121						0000	2		5	000.009									5
			0123						0000	1		5	000.068	00.03	00.03	00.18	00.24	0.02-	0.04			5
			0124						0000	1		5	000.103	00.03	00.03	00.18	00.24	0.02-	0.04			5
			0126						0004	1		5	000.061	00.03	00.01-	00.19	00.21	0.00	0.02			5
			0127						0004	1		5	000.078	00.03	00.01-	00.19	00.21	0.00	0.02			5
			0129						0024	1		5	000.025	00.02	00.01	00.19	00.22	0.01-	0.03			5
			0130						0024	1		5	000.023	00.02	00.01	00.19	00.22	0.01-	0.03			5
			0132						0060	1		5	000.019	00.01	00.01-	00.23	00.22	0.02-	0.02			5
			0133						0060	1		5	000.014	00.01	00.01-	00.23	00.22	0.02-	0.02			5
			0135						0102	1		5	000.001	00.09	00.09	00.58	00.77	0.04-	0.07			5
			0136						0102	1*		5	000.004-	00.09	00.09	00.58	00.77	0.04-	0.07			5
			0138	11		1417N	17952E	055	0000	1*		5	000.019-	00.02	00.05	00.17	00.24	0.03-	0.04			5
			0139						0000	1		5	000.128	00.02	00.05	00.17	00.24	0.03-	0.04			5
			0141	12					0004	1		5	000.025	00.15	00.01	00.14	00.30	0.02	0.03			5
			0142						0004	1		5	000.029	00.15	00.01	00.14	00.30	0.02	0.03			5
			0144						0010	1		5	000.008	00.10	00.06	00.35-	00.19-	0.02	0.00			5
			0145						0010	1		5	000.011	00.10	00.06	00.35-	00.19-	0.02	0.00			5
			0147						0054	1		5	000.002	00.04	00.02	00.41	00.47	0.00	0.05			5
			0148						0054	1		5	000.023	00.04	00.02	00.41	00.47	0.00	0.05			5
			0150						0099	1		5	000.009	00.04	00.04	00.13-	00.05-	0.02	0.00			5
			0151						0099	1		5	000.015	00.04	00.04	00.13-	00.05-	0.02	0.00			5
			0156	11					0000	2		5	000.051									5
			0157						0000	2		5	000.059									5

VE CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1 2 3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR
NO 67	0003	0159	11	19/11/61	1417N	17952E	055	0000	2 5	000.006									NO67 5
		0160						0000	2 5	000.050									5
		0161						0000	2 5	000.017									5
		0162						0000	2 5	000.017									5
		0163						0000	2 5	000.019									5
		0164						0000	2 5	000.003									5
	0004	0165	06	20/11/61	1102N	17958W	054	0000	1 5	000.082	00.04	00.04	00.04	00.11	0.01	0.01			5
		0166						0000	1 5	000.068	00.04	00.04	00.04	00.11	0.01	0.01			5
		0168						0004	1 5	000.048	00.02	00.05	00.21-	00.14-	0.00	0.00			5
		0169						0004	1 5	000.050	00.02	00.05	00.21-	00.14-	0.00	0.00			5
		0171						0010	1 5	000.032	00.05	00.03	00.09-	00.01-	0.00	0.01			5
		0172						0010	1 5	000.016	00.05	00.03	00.09-	00.01-	0.00	0.01			5
		0174						0054	1 5	000.000	00.04	00.07	00.13-	00.02-	0.04-	0.04			5
		0175						0054	1 5	000.001	00.04	00.07	00.13-	00.02-	0.04-	0.04			5
		0177						0099	1 5	000.007	00.04	00.05	00.08	00.18	0.01	0.01			5
		0178						0099	1 5	000.011	00.04	00.05	00.08	00.18	0.01	0.01			5
		0180						0000	2 9*5	000.050	00.00	00.01-	00.01	00.00	0.01	0.00			5
		0181						0000	2 9*5	000.050	00.00	00.01-	00.01	00.00	0.01	0.00			5
		0183						0000	2 5	000.024									5
		0184						0000	2 5	000.017									5
		0186						0000	2 5	000.007									5
		0187						0000	2 5	000.022									5
		0189						0000	2 5	000.003									5
		0190						0000	2 5	000.005									5
		0192	11					0000	1 5	000.027	00.02	00.04	00.24-	00.17-	0.00	0.00			5
		0193						0000	1 5	000.016	00.02	00.04	00.24-	00.17-	0.00	0.00			5
		0195						0014	1 5	000.005	00.04	00.05	00.12	00.21	0.01-	0.05			5
		0196						0014	1 5	000.003	00.04	00.05	00.12	00.21	0.01-	0.05			5
		0198						0028	1* 5	000.020-	00.01	00.03	00.24-	00.20-	0.01	0.00			5
		0199						0028	1 5	000.011	00.01	00.03	00.24-	00.20-	0.01	0.00			5
		0201						0066	1* 5	000.004-	00.05	00.07	00.10-	00.01	0.00	0.02			5
		0202						0066	1* 5	000.001-	00.05	00.07	00.10-	00.01	0.00	0.02			5
		0204						0105	1 5	000.004	00.02	00.03	00.13-	00.07-	0.02	0.01-			5
		0205						0105	1 5	000.052	00.02	00.03	00.13-	00.07-	0.02	0.01-			5
		0210						0000	2 5	000.001									5
		0211						0000	2 5	000.010									5
		0213						0000	2* 5	000.002-									5
		0214						0000	2* 5	000.004-									5
		0215						0000	2* 5	000.002-									5
		0216						0000	2 5	000.004									5
		0217						0000	2* 5	000.005-									5
		0218						0000	2* 5	000.001-									5
	0005	0219	06	21/11/61	0815N	17950W	018	0000	1 5	000.113	00.04	00.05	00.01	00.09	0.00	0.01			5
		0220						0000	1 5	000.122	00.04	00.05	00.01	00.09	0.00	0.01			5
		0222						0014	1 5	000.081	00.02	00.01	00.19-	00.16-	0.02	0.01-			5
		0223						0014	1 5	000.070	00.02	00.01	00.19-	00.16-	0.02	0.01-			5
		0225						0028	1 4		00.05	00.05	00.08-	00.02	0.02-	0.04			5
		0228						0066	1 4		00.03	00.04	00.18-	00.11-	0.02	0.01			5
		0229						0105	1 4		00.07	00.05	00.02	00.14	0.02	0.01			5
		0230						0000	2 9*4		00.01	00.01	00.03-	00.00	0.02	0.01-			5
		0231						0000	2 5	000.039									5
		0232						0000	2 5	000.037									5

VE	CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1	2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR
NO	67	0005	0234	06	21/11/61	0815N	17950W	018	0000	2		5	000.013									NO67 5
			0235						0000	2		5	000.018									5
			0237						0000	2		5	000.009									5
			0238						0000	2*		5	000.013-									5
			0240	11		0816N	17951W		0000	1		5	000.002	00.05	00.03-	00.30	00.32	0.01-	0.04			5
			0241						0000	1		5	000.020	00.05	00.03-	00.30	00.32	0.01-	0.04			5
			0243						0006	1		5	000.001	00.04	00.02	00.44	00.50	0.02-	0.06			5
			0244						0006	1		5	000.002	00.04	00.02	00.44	00.50	0.02-	0.06			5
			0246						0041	1		5	000.000	00.02	00.02-	00.25	00.26	0.02-	0.03			5
			0247						0041	1*		5	000.001-	00.02	00.02-	00.25	00.26	0.02-	0.03			5
			0249						0078	1		5	000.002	00.11	00.04	00.73	00.88	0.02-	0.07			5
			0250						0078	1		5	000.003	00.11	00.04	00.73	00.88	0.02-	0.07			5
			0252						0102	1*		5	000.017-	00.04	00.01	00.13	00.18	0.00	0.02			5
			0253						0102	1*		5	000.011-	00.04	00.01	00.13	00.18	0.00	0.02			5
			0258						0000	2*		5	000.007-									5
			0259						0000	2		5	000.006									5
			0261						0000	2*		5	000.004-									5
			0262						0000	2		5	000.002									5
			0263						0000	2*		5	000.006-									5
			0264						0000	2		5	000.009									5
			0265						0000	2		5	000.006									5
			0266						0000	2		5	000.010									5
		0006	0267	09	22/11/61	0515N	17957W		0000	1		5	000.019	00.05	00.00	00.26	00.31	0.00	0.02			5
			0268						0000	1		5	000.019	00.05	00.00	00.26	00.31	0.00	0.02			5
			0270	10					0000	1*		5	000.001-	00.00	00.00	00.05	00.05	0.00	0.00			5
			0271						0000	1		5	000.008	00.00	00.00	00.05	00.05	0.00	0.00			5
			0273	11					0006	1*		5	000.012-	00.05	00.01-	00.21	00.25	0.03-	0.04			5
			0274						0006	1		5	000.010	00.05	00.01-	00.21	00.25	0.03-	0.04			5
			0276						0031	1		5	000.001	00.03	00.00	00.03	00.06	0.00	0.00			5
			0277						0031	1*		5	000.001-	00.03	00.00	00.03	00.06	0.00	0.00			5
			0279						0062	1		5	000.013	00.04	00.03	00.30	00.37	0.01-	0.04			5
			0280						0062	1		5	000.011	00.04	00.03	00.30	00.37	0.01-	0.04			5
			0282						0092	1*		5	000.001-	00.05	00.01	00.01-	00.06	0.01	0.01			5
			0283						0092	1*		5	000.006-	00.05	00.01	00.01-	00.06	0.01	0.01			5
			0288	10					0000	2*		5	000.006-									5
			0289						0000	2*		5	000.008-									5
			0291						0000	2		5	000.000									5
			0292						0000	2*		5	000.014-									5
			0293						0000	2		5	000.008									5
			0294						0000	2*		5	000.012-									5
			0295						0000	2*		5	000.007-									5
			0296						0000	2		5	000.005									5
		0007	0297	06	23/11/61	0158N	17946E	019	0000	1		5	000.441	00.09	00.02	00.20	00.32	0.00	0.03			5
			0298						0000	1		5	000.385	00.09	00.02	00.20	00.32	0.00	0.03			5
			0300	07					0006	1		5	000.445	00.05	00.03-	00.27	00.29	0.01-	0.02			5
			0301						0006	1		5	000.369	00.05	00.03-	00.27	00.29	0.01-	0.02			5
			0303						0031	1		5	000.212	00.04	00.04	00.23	00.31	0.01	0.01			5
			0304						0031	1		5	000.237	00.04	00.04	00.23	00.31	0.01	0.01			5
			0306						0062	1		5	000.031	00.11	00.07	00.40	00.58	0.01-	0.05			5
			0307						0062	1		5	000.017	00.11	00.07	00.40	00.58	0.01-	0.05			5
			0309						0092	1		5	000.000	00.04	00.02	00.25	00.31	0.01	0.01			5
			0310						0092	1		5	000.010	00.04	00.02	00.25	00.31	0.01	0.01			5

VE CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1 2 3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR
NO 67	0007	0312	06	23/11/61	0158N	17946E	019	0000	2 9*5	000.271	00.19	00.09	00.34	00.62	0.06	0.03			NO67 5
		0313						0000	2 9*5	000.372	00.19	00.09	00.34	00.62	0.06	0.03			5
		0315						0000	2 5	000.139									5
		0316						0000	2 5	000.161									5
		0318						0000	2 5	000.059									5
		0319						0000	2 5	000.056									5
		0321						0000	2 5	000.040									5
		0322						0000	2 5	000.057									5
		0324	11					0000	1 5	000.176	00.06	00.04	00.30	00.41	0.01-	0.02			5
		0325						0000	1 5	000.148	00.06	00.04	00.30	00.41	0.01-	0.02			5
		0327	12					0008	1 5	000.094	00.09	00.07	00.33	00.48	0.01-	0.04			5
		0328						0008	1 5	000.110	00.09	00.07	00.33	00.48	0.01-	0.04			5
		0330						0023	1 5	000.020	00.06	00.02	00.13	00.22	0.02	0.01			5
		0331						0023	1 5	000.038	00.06	00.02	00.13	00.22	0.02	0.01			5
		0333						0037	1 5	000.042	00.16	00.10	00.66	00.92	0.02-	0.06			5
		0334						0037	1* 5	000.004-	00.16	00.10	00.66	00.92	0.02-	0.06			5
		0336						0058	1 5	000.000	00.09	00.09	00.27	00.45	0.01	0.02			5
		0337						0058	1 5	000.002	00.09	00.09	00.27	00.45	0.01	0.02			5
		0339	11					0000	2 9*5	000.077	00.12	00.05	00.25	00.43	0.03	0.04			5
		0340						0000	2 9*5	000.133	00.12	00.05	00.25	00.43	0.03	0.04			5
		0342						0000	2 5	000.051									5
		0343						0000	2 5	000.060									5
		0344						0000	2 5	000.038									5
		0345						0000	2 5	000.034									5
		0346						0000	2 5	000.066									5
		0347						0000	2 5	000.071									5
	0008	0351	08	24/11/61	0057S	17958W	317	0000	1 5	000.500	00.08	00.08	00.19-	00.03-	0.00	0.01			5
		0352						0000	1 5	000.506	00.08	00.08	00.19-	00.03-	0.00	0.01			5
		0354						0008	1 5	000.292	00.06	00.02	00.06	00.14	0.04	0.00			5
		0355						0008	1 5	000.338	00.06	00.02	00.06	00.14	0.04	0.00			5
		0357						0023	1 5	000.123	00.07	00.02	00.34	00.43	0.02	0.03			5
		0358						0023	1 5	000.097	00.07	00.02	00.34	00.43	0.02	0.03			5
		0360						0037	1 5	000.061	00.23	00.15	00.69	01.06	0.00	0.09			5
		0361						0037	1 5	000.056	00.23	00.15	00.69	01.06	0.00	0.09			5
		0363						0058	1 5	000.004	00.25	00.16	00.81	01.22	0.03	0.08			5
		0364						0058	1 5	000.002	00.25	00.16	00.81	01.22	0.03	0.08			5
		0366						0000	2 9*5	000.165	00.08	00.07	00.39	00.54	0.03	0.03			5
		0367						0000	2 9*5	000.169	00.08	00.07	00.39	00.54	0.03	0.03			5
		0369						0000	2 5	000.076									5
		0370						0000	2 5	000.062									5
		0372						0000	2 5	000.045									5
		0373						0000	2 5	000.042									5
		0375						0000	2 5	000.022									5
		0376						0000	2 5	000.018									5
		0378	13					0000	1 5	000.115	00.07	00.07	00.16	00.31	0.02	0.03			5
		0379						0000	1 5	000.125	00.07	00.07	00.16	00.31	0.02	0.03			5
		0381						0010	1 5	000.096	00.20	00.14	00.89	01.23	0.00	0.10			5
		0382						0010	1 5	000.093	00.20	00.14	00.89	01.23	0.00	0.10			5
		0384						0028	1 5	000.020	00.10	00.02	00.23	00.35	0.03	0.03			5
		0385						0028	1 5	000.005	00.10	00.02	00.23	00.35	0.03	0.03			5
		0387						0035	1 5	000.001	00.13	00.08	00.71	00.93	0.01	0.05			5
		0388						0035	1 5	000.002	00.13	00.08	00.71	00.93	0.01	0.05			5

VE	CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1 2 3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR
NO	67	0008	0390	13	24/11/61	0057S	17958W	317	0059	1* 5	000.010-	00.05	00.01	00.22	00.28	0.02	0.01			N067 5
			0391						0059	1 5	000.000	00.05	00.01	00.22	00.28	0.02	0.01			5
			0393						0000	2 9*5	000.053	00.07	00.05	00.12	00.24	0.01	0.02			5
			0394						0000	2 9*5	000.035	00.07	00.05	00.12	00.24	0.01	0.02			5
			0396						0000	2 5	000.015									5
			0397						0000	2 5	000.033									5
			0398						0000	2* 5	000.001-									5
			0399						0000	2 5	000.012									5
			0400						0000	2 5	000.016									5
			0401						0000	2 5	000.019									5
		0009	0405	07	25/11/61	0400S	17959W		0000	1 5	000.161	00.04	00.05	00.01-	00.09	0.01	0.01			5
			0406						0000	1 5	000.165	00.04	00.05	00.01-	00.09	0.01	0.01			5
			0408						0010	1 5	000.130	00.01	00.01-	00.16	00.16	0.02	0.01			5
			0409						0010	1 5	000.104	00.01	00.01-	00.16	00.16	0.02	0.01			5
			0411						0028	1 5	000.038	00.07	00.03	00.52	00.62	0.01-	0.06			5
			0412						0028	1 5	000.038	00.07	00.03	00.52	00.62	0.01-	0.06			5
			0414						0035	1 5	000.018	00.03	00.03	00.24	00.31	0.02	0.03			5
			0415						0035	1 5	000.020	00.03	00.03	00.24	00.31	0.02	0.03			5
			0417						0059	1 5	000.016	00.08	00.00	00.55	00.63	0.01-	0.05			5
			0418						0059	1 5	000.010	00.08	00.00	00.55	00.63	0.01-	0.05			5
			0420						0000	2 9*5	000.109	00.08	00.03	00.25	00.36	0.02	0.02			5
			0421						0000	2 9*5	000.086	00.08	00.03	00.25	00.36	0.02	0.02			5
			0423						0000	2 5	000.052									5
			0424						0000	2 5	000.046									5
			0426						0000	2 5	000.029									5
			0427						0000	2 5	000.033									5
			0429						0000	2 5	000.018									5
			0430						0000	2 5	000.021									5
			0432	13					0000	1 5	000.003	00.02	00.02	00.19	00.22	0.29	0.20-			5
			0433						0000	1 5	000.003	00.02	00.02	00.19	00.22	0.29	0.20-			5
			0435						0007	1* 5	000.001-	00.04	00.02	00.41	00.47	0.01-	0.05			5
			0436						0007	1 5	000.001	00.04	00.02	00.41	00.47	0.01-	0.05			5
			0438						0041	1* 5	000.016-	00.03	00.00	00.23	00.25	0.00	0.04			5
			0439						0041	1* 5	000.004-	00.03	00.00	00.23	00.25	0.00	0.04			5
			0441						0066	1* 5	000.003-	00.07	00.05	00.01-	00.11	0.00	0.04			5
			0442						0066	1* 5	000.004-	00.07	00.05	00.01-	00.11	0.00	0.04			5
			0444						0087	1* 5	000.002-	00.09	00.04	00.10	00.23	0.03	0.05			5
			0445						0087	1 5	000.002	00.09	00.04	00.10	00.23	0.03	0.05			5
			0447						0000	2 9*5	000.070	00.03	00.02	00.04	00.08	0.03	0.01			5
			0448						0000	2 9*5	000.031	00.03	00.02	00.04	00.08	0.03	0.01			5
			0450						0000	2 5	000.084									5
			0451						0000	2 5	000.087									5
			0452						0000	2 5	000.009									5
			0453						0000	2 5	000.014									5
			0454						0000	2 5	000.012									5
			0455						0000	2 5	000.006									5
		0010	0459	06	26/11/61	0556S	17955W		0000	1 5	000.025	00.04	00.06	00.06-	00.04	0.00	0.03			5
			0460						0000	1 5	000.030	00.04	00.06	00.06-	00.04	0.00	0.03			5
			0462						0007	1 5	000.029	00.04	00.05	00.07-	00.02	0.01-	0.07			5
			0463						0007	1 5	000.031	00.04	00.05	00.07-	00.02	0.01-	0.07			5
			0465						0041	1* 5	000.029-	00.05	00.07	00.14-	00.02-	0.00	0.04			5
			0466						0041	1 5	000.018	00.05	00.07	00.14-	00.02-	0.00	0.04			5

VE	CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1	2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR
NO	67	0010	0468	06	26/11/61	0556S	17955W	317	0066	1		5	000.015	00.05	00.05	00.12-	00.02-	0.03	0.02			N067 5
			0469						0066	1		5	000.027	00.05	00.05	00.12-	00.02-	0.03	0.02			5
			0471						0087	1		5	000.017	00.10	00.03	00.11	00.24	0.02	0.03			5
			0472						0087	1		5	000.018	00.10	00.03	00.11	00.24	0.02	0.03			5
			0474						0000	2	9*	5	000.010	00.04	00.03	00.18	00.24	0.01	0.02			5
			0475						0000	2	9*	5	000.022	00.04	00.03	00.18	00.24	0.01	0.02			5
			0477						0000	2		5	000.013									5
			0478						0000	2		5	000.010									5
			0480						0000	2*		5	000.004-									5
			0481						0000	2*		5	000.003-									5
			0483						0000	2		5	000.009									5
			0484						0000	2		5	000.006									5
			0486	09		0703S			0000	1		5	000.021									5
			0487						0000	1		5	000.018									5
			0489	11		0747S	18000E	318	0000	1		5	000.029	00.02	00.01	00.09-	00.06-	0.01	0.01			5
			0490						0000	1		5	000.018	00.02	00.01	00.09-	00.06-	0.01	0.01			5
			0492						0006	1*		5	000.030-	00.05	00.06	00.06-	00.05	0.02	0.03			5
			0493						0006	1*		5	000.014-	00.05	00.06	00.06-	00.05	0.02	0.03			5
			0495						0033	1*		5	000.009-	00.00	00.02	00.06-	00.04-	0.02	0.01			5
			0496						0033	1*		5	000.011-	00.00	00.02	00.06-	00.04-	0.02	0.01			5
			0498						0064	1*		5	000.002-	00.09	00.11	00.09	00.29	0.01	0.06			5
			0499						0064	1*		5	000.016-	00.09	00.11	00.09	00.29	0.01	0.06			5
			0501	12					0095	1*		5	000.006-	00.16	00.06	00.01	00.22	0.00	0.06			5
			0502						0095	1*		5	000.013-	00.16	00.06	00.01	00.22	0.00	0.06			5
			0504	11					0000	2*	9*	5	000.006-	00.02	00.01	00.06-	00.03-	0.01	0.00			5
			0505						0000	2*	9*	5	000.007-	00.02	00.01	00.06-	00.03-	0.01	0.00			5
			0507						0000	2*		5	000.009-									5
			0508						0000	2*		5	000.006-									5
			0509						0000	2*		5	000.010-									5
			0510						0000	2*		5	000.011-									5
			0511						0000	2*		5	000.006-									5
			0512						0000	2*		5	000.006-									5
		0011	0516	06	27/11/61	0959S	17958W	317	0000	1		5	000.056	00.04	00.07	00.15-	00.05-	0.00	0.03			5
			0517						0000	1		5	000.064	00.04	00.07	00.15-	00.05-	0.00	0.03			5
			0519						0006	1		5	000.033	00.01	00.03	00.21-	00.17-	0.04	0.01			5
			0520						0006	1		5	000.014	00.01	00.03	00.21-	00.17-	0.04	0.01			5
			0522						0033	1		5	000.023	00.05	00.07	00.17	00.30	0.01	0.05			5
			0523						0033	1		5	000.009	00.05	00.07	00.17	00.30	0.01	0.05			5
			0525						0064	1		5	000.004	00.02	00.00	00.05-	00.03-	0.03	0.01			5
			0526						0064	1		5	000.004	00.02	00.00	00.05-	00.03-	0.03	0.01			5
			0528						0095	1*		5	000.020-	00.13	00.14	00.32	00.60	0.05-	0.10			5
			0529						0095	1*		5	000.007-	00.13	00.14	00.32	00.60	0.05-	0.10			5
			0531						0000	2	9*	5	000.025	00.02	00.01-	00.02-	00.00	0.00	0.01			5
			0532						0000	2	9*	5	000.032	00.02	00.01-	00.02-	00.00	0.00	0.01			5
			0534						0000	2		5	000.016									5
			0535						0000	2		5	000.011									5
			0537						0000	2		5	000.010									5
			0538						0000	2		5	000.006									5
			0540						0000	2		5	000.004									5
			0541						0000	2		5	000.002									5
			0543	12		1121S	18000E		0000	1		5	000.054	00.04	00.02	00.44	00.50	0.04-	0.06			5
			0544						0000	1		5	000.054	00.04	00.02	00.44	00.50	0.04-	0.06			5

VE	CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1	2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR
NO	67	0011	0546	12	27/11/61	1121S	18000E	317	0004	1		5	000.035	00.04	00.02	00.25	00.31	0.01-	0.05			NO67 5
			0547						0004	1		5	000.033	00.04	00.02	00.25	00.31	0.01-	0.05			5
			0549						0024	1		5	000.017	00.02	00.00	00.30	00.32	0.03-	0.05			5
			0550						0024	1		5	000.016	00.02	00.00	00.30	00.32	0.03-	0.05			5
			0552						0048	1		5	000.015	00.05	00.00	00.55	00.60	0.03-	0.07			5
			0553						0048	1		5	000.010	00.05	00.00	00.55	00.60	0.03-	0.07			5
			0555						0089	1*		5	000.007-	00.04	00.03	00.27	00.34	0.02-	0.06			5
			0556						0089	1		5	000.003	00.04	00.03	00.27	00.34	0.02-	0.06			5
			0558						0000	2	9*	5	000.023	00.00	00.01-	00.06	00.05	0.07-	0.14			5
			0559						0000	2	9*	5	000.035	00.00	00.01-	00.06	00.05	0.07-	0.14			5
			0561						0000	2		5	000.012									5
			0562						0000	2		5	000.013									5
			0563						0000	2		5	000.008									5
			0564						0000	2		5	000.011									5
			0565						0000	2		5	000.005									5
			0566						0000	2		5	000.003									5
		0014	0570	11	29/11/61	1259S	17320W	353	0000	1		5	000.043	00.04	00.01	00.32	00.37	0.02-	0.05			5
			0571						0000	1		5	000.054	00.04	00.01	00.32	00.37	0.02-	0.05			5
			0573						0009	1		5	000.019	00.01	00.02	00.13	00.15	0.03-	0.06			5
			0574						0009	1		5	000.028	00.01	00.02	00.13	00.15	0.03-	0.06			5
			0576						0023	1		5	000.014	00.08	00.01	00.37	00.46	0.01-	0.05			5
			0577						0023	1		5	000.011	00.08	00.01	00.37	00.46	0.01-	0.05			5
			0579						0062	1*		5	000.007-	00.05	00.01	00.51	00.57	0.03-	0.06			5
			0580						0062	1*		5	000.008-	00.05	00.01	00.51	00.57	0.03-	0.06			5
			0582						0096	1		5	000.004	00.14	00.10	00.84	01.08	0.08-	0.14			5
			0583						0096	1		5	000.002	00.14	00.10	00.84	01.08	0.08-	0.14			5
			0585						0000	2		5	000.023									5
			0586						0000	2		5	000.036									5
			0588						0000	2		5	000.012									5
			0589						0000	2		5	000.014									5
			0590						0000	2		5	000.013									5
			0591						0000	2		5	000.007									5
			0592						0000	2		5	000.005									5
			0593						0000	2		5	000.026									5
			0597	13	30/11/61	1151S	16812W	352	0000	1		5	000.016	00.07	00.04	00.54	00.65	0.03-	0.09			5
			0598						0000	1		5	000.012	00.07	00.04	00.54	00.65	0.03-	0.09			5
			0600		01/12/61	1030S	16220W		0000	1		5	000.028	00.09	00.06	00.44	00.58	0.03-	0.07			5
			0601						0000	1		5	000.173	00.09	00.06	00.44	00.58	0.03-	0.07			5
		0015	0606	06	02/12/61	1005S	16006W		0000	1		5	000.082	00.01	00.00	00.18	00.19	0.01-	0.03			5
			0607						0000	1		5	000.070	00.01	00.00	00.18	00.19	0.01-	0.03			5
			0609						0009	1		5	000.041	00.07	00.02	00.48	00.56	0.02-	0.05			5
			0610						0009	1		5	000.040	00.07	00.02	00.48	00.56	0.02-	0.05			5
			0612						0023	1		5	000.012	00.12	00.13	00.82	01.08	0.20-	0.16			5
			0613						0023	1		5	000.010	00.12	00.13	00.82	01.08	0.20-	0.16			5
			0615						0062	1*		5	000.003-	00.05	00.03	00.22	00.30	0.03-	0.06			5
			0616						0062	1		5	000.003	00.05	00.03	00.22	00.30	0.03-	0.06			5
			0618	07					0096	1		5	000.267	00.05	00.03	00.38	00.46	0.02-	0.06			5
			0619						0096	1		5	000.061	00.05	00.03	00.38	00.46	0.02-	0.06			5
			0621	06					0000	2		5	000.041									5
			0622						0000	2		5	000.036									5
			0624						0000	2		5	000.009									5
			0625						0000	2		5	000.016									5

VE	CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1	2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR
NO	67	0015	0627	06	02/12/61	1005S	16006W	352	0000	2		5	000.001									N067 5
			0628						0000	2		5	000.007									5
			0630						0000	2		5	000.003									5
			0631						0000	2		5	000.006									5
			0633	12		0915S	16005W	316	0000	1		5	000.004	00.05	00.02	00.30	00.37	0.01-	0.05			5
			0634						0000	1		5	000.004	00.05	00.02	00.30	00.37	0.01-	0.05			5
			0636						0009	1		5	000.003	00.03	00.87	00.30-	00.60	0.03-	0.07			5
			0637						0009	1*		5	000.002-	00.03	00.87	00.30-	00.60	0.03-	0.07			5
			0639						0032	1*		5	000.002-	00.04	00.03	00.50	00.56	0.04-	0.07			5
			0640						0032	1		5	000.006	00.04	00.03	00.50	00.56	0.04-	0.07			5
			0642						0059	1*		5	000.013-	00.07	00.01	00.62	00.70	0.03-	0.08			5
			0643						0059	1*		5	000.001-	00.07	00.01	00.62	00.70	0.03-	0.08			5
			0645						0099	1		5	000.003	00.09	00.03	00.34	00.46	0.00	0.03			5
			0646						0099	1		5	000.005	00.09	00.03	00.34	00.46	0.00	0.03			5
			0648						0000	2		5	000.007									5
			0649						0000	2		5	000.006									5
			0651						0000	2		5	000.001									5
			0652						0000	2		5	000.005									5
			0653						0000	2		5	000.000									5
			0654						0000	2		5	000.003									5
			0655						0000	2		5	000.003									5
			0656						0000	2		5	000.011									5
		0016	0660	06	03/12/61	0700S	16000W		0000	1		5	000.178	00.03	00.02	00.14	00.18	0.01-	0.03			5
			0661						0000	1		5	000.231	00.03	00.02	00.14	00.18	0.01-	0.03			5
			0663						0009	1		5	000.152	00.09	00.07	00.15-	00.00	0.02	0.01			5
			0664						0009	1		5	000.150	00.09	00.07	00.15-	00.00	0.02	0.01			5
			0666						0032	1		5	000.065	00.05	00.03	00.22	00.30	0.01	0.01			5
			0667						0032	1		5	000.053	00.05	00.03	00.22	00.30	0.01	0.01			5
			0669						0059	1		5	000.019	00.07	00.02	00.32	00.41	0.01-	0.03			5
			0670						0059	1		5	000.018	00.07	00.02	00.32	00.41	0.01-	0.03			5
			0672	07					0099	1		5	000.011	00.03	00.01-	00.23	00.25	0.03-	0.03			5
			0673						0099	1		5	000.020	00.03	00.01-	00.23	00.25	0.03-	0.03			5
			0675	06					0000	2		5	000.162									5
			0676						0000	2		5	000.155									5
			0678						0000	2		5	000.096									5
			0679						0000	2		5	000.092									5
			0681						0000	2		5	000.058									5
			0682						0000	2		5	000.044									5
			0684						0000	2		5	000.027									5
			0685						0000	2		5	000.026									5
			0687	11		0621S	16009W		0000	1		5	000.003	00.07	00.01	00.23	00.31	0.01-	0.03			5
			0688						0000	1		5	000.005	00.07	00.01	00.23	00.31	0.01-	0.03			5
			0690						0008	1		5	000.015	00.06	00.11	00.14	00.32	0.04-	0.06			5
			0691						0008	1		5	000.015	00.06	00.11	00.14	00.32	0.04-	0.06			5
			0693						0028	1*		5	000.005-	00.08	00.03	00.51	00.62	0.01-	0.05			5
			0694						0028	1*		5	000.001-	00.08	00.03	00.51	00.62	0.01-	0.05			5
			0696						0035	1*		5	000.003-	00.07	00.03	00.37	00.46	0.00	0.05			5
			0697						0035	1		5	000.001	00.07	00.03	00.37	00.46	0.00	0.05			5
			0699						0087	1		5	000.003	00.07	00.04	00.41	00.52	0.01-	0.05			5
			0700						0087	1		5	000.004	00.07	00.04	00.41	00.52	0.01-	0.05			5
			0702						0000	2		5	000.006									5
			0703						0000	2		5	000.015									5

VE CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1	2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR
NO 67	0016	0705	11	03/12/61	0621S	16009W	316	0000	2		5	000.001									N067 5
		0706						0000	2		5	000.003									5
		0707						0000	2		5	000.002									5
		0708						0000	2		5	000.006									5
		0709						0000	2		5	000.003									5
		0710						0000	2		5	000.000									5
	0017	0714	06	04/12/61	0400S	16000W		0000	1		5	000.249	00.06	00.01-	00.07	00.12	0.02	0.01			5
		0715						0000	1		5	000.200	00.06	00.01-	00.07	00.12	0.02	0.01			5
		0717						0008	1		5	000.190	00.04	00.03	00.14	00.21	0.00	0.02			5
		0718						0008	1		5	000.136	00.04	00.03	00.14	00.21	0.00	0.02			5
		0720						0028	1		5	000.049	00.01	00.00	00.08	00.09	0.00	0.01			5
		0721						0028	1		5	000.064	00.01	00.00	00.08	00.09	0.00	0.01			5
		0723						0035	1		5	000.013	00.04	00.06	00.40	00.49	0.00	0.04			5
		0724						0035	1		5	000.016	00.04	00.06	00.40	00.49	0.00	0.04			5
		0726						0087	1		5	000.010	00.03	00.00	00.15	00.19	0.01	0.01			5
		0727						0087	1*		5	000.010-	00.03	00.00	00.15	00.19	0.01	0.01			5
		0729						0000	2		5	000.127									5
		0730						0000	2		5	000.139									5
		0732						0000	2		5	000.100									5
		0733						0000	2		5	000.059									5
		0735						0000	2		5	000.000									5
		0736						0000	2		5	000.017									5
		0738						0000	2		5	000.009									5
		0739						0000	2		5	000.007									5
		0741	12		0333S	16019W		0000	1		5	000.007	00.06	00.01	00.18	00.25	0.01-	0.03			5
		0742						0000	1		5	000.010	00.06	00.01	00.18	00.25	0.01-	0.03			5
		0744						0007	1		5	000.013	00.03	00.00	00.18	00.21	0.00	0.02			5
		0745						0007	1		5	000.019	00.03	00.00	00.18	00.21	0.00	0.02			5
		0747						0029	1*		5	000.005-	00.05	00.07	00.21	00.33	0.01-	0.04			5
		0748						0029	1		5	000.000	00.05	00.07	00.21	00.33	0.01-	0.04			5
		0750						0052	1		5	000.006	00.03	00.01	00.11	00.15	0.04-	0.07			5
		0751						0052	1		5	000.005	00.03	00.01	00.11	00.15	0.04-	0.07			5
		0753						0081	1*		5	000.003-	00.09	00.05	00.41	00.55	0.01-	0.04			5
		0754						0081	1		5	000.001	00.09	00.05	00.41	00.55	0.01-	0.04			5
		0756						0000	2		5	000.007									5
		0757						0000	2		5	000.019									5
		0759						0000	2		5	000.001									5
		0760						0000	2		5	000.000									5
		0761						0000	2*		5	000.002-									5
		0762						0000	2		5	000.011									5
		0763						0000	2		5	000.005									5
		0764						0000	2		5	000.013									5
	0018	0768	06	05/12/61	0100S	16000W		0000	1		5	000.451	00.09	00.05	00.26	00.41	0.01	0.03			5
		0769						0000	1		5	000.440	00.09	00.05	00.26	00.41	0.01	0.03			5
		0771						0007	1		5	000.316	00.13	00.08	00.60	00.82	0.01-	0.06			5
		0772						0007	1		5	000.251	00.13	00.08	00.60	00.82	0.01-	0.06			5
		0774						0029	1		5	000.119	00.13	00.04	00.40	00.57	0.01	0.04			5
		0775						0029	1		5	000.136	00.13	00.04	00.40	00.57	0.01	0.04			5
		0777						0052	1		5	000.050	00.18	00.09	00.80	01.07	0.02-	0.08			5
		0778						0052	1		5	000.040	00.18	00.09	00.80	01.07	0.02-	0.08			5
		0780						0081	1		5	000.026	00.13	00.07	00.51	00.70	0.01-	0.05			5
		0781						0081	1		5	000.029	00.13	00.07	00.51	00.70	0.01-	0.05			5

VE	CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1 2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR
NO	67	0018	0783	06	05/12/61	0100S	16000W	316	0000	2*	5	000.010-									NO67 5
			0784						0000	2	5	000.185									5
			0786						0000	2	5	000.141									5
			0787						0000	2	5	000.147									5
			0789						0000	2	5	000.053									5
			0790						0000	2	5	000.056									5
			0792						0000	2	5	000.039									5
			0793						0000	2	5	000.045									5
			0795	12		0007S	16005W		0000	1	5	000.065	00.07	00.04	00.20	00.30	0.00	0.03			5
			0796						0000	1	5	000.166	00.07	00.04	00.20	00.30	0.00	0.03			5
			0798						0007	1	5	000.051	00.13	00.07	00.47	00.67	0.01	0.06			5
			0799						0007	1	5	000.080	00.13	00.07	00.47	00.67	0.01	0.06			5
			0801						0021	1	5	000.006	00.07	00.04	00.19	00.30	0.00	0.03			5
			0802						0021	1	5	000.004	00.07	00.04	00.19	00.30	0.00	0.03			5
			0804						0034	1*	5	000.011-	00.09	00.05	00.22	00.36	0.00	0.04			5
			0805						0034	1*	5	000.001-	00.09	00.05	00.22	00.36	0.00	0.04			5
			0807						0070	1*	5	000.005-	00.12	00.08	00.40	00.60	0.03-	0.06			5
			0808						0070	1	5	000.000	00.12	00.08	00.40	00.60	0.03-	0.06			5
			0810						0000	2	5	000.078									5
			0811						0000	2	5	000.060									5
			0813						0000	2	5	000.022									5
			0814						0000	2	5	000.030									5
			0815						0000	2	5	000.013									5
			0816						0000	2	5	000.032									5
			0817						0000	2	5	000.014									5
			0818						0000	2	5	000.024									5
		0019	0822	05	06/12/61	0200N	16000W	017	0000	1	5	000.254	00.06	00.04	00.12	00.22	0.01-	0.03			5
			0823						0000	1	5	000.270	00.06	00.04	00.12	00.22	0.01-	0.03			5
			0825						0007	1	5	000.217	00.10	00.07	00.45	00.61	0.02-	0.06			5
			0826						0007	1	5	000.199	00.10	00.07	00.45	00.61	0.02-	0.06			5
			0828						0021	1	5	000.062	00.05	00.04	00.06	00.15	0.01	0.03			5
			0829						0021	1	5	000.013	00.05	00.04	00.06	00.15	0.01	0.03			5
			0831						0034	1	5	000.012	00.09	00.05	00.32	00.46	0.01-	0.04			5
			0832						0034	1	5	000.027	00.09	00.05	00.32	00.46	0.01-	0.04			5
			0834	06					0070	1	5	000.007	00.05	00.02	00.27	00.34	0.02-	0.05			5
			0835						0070	1	5	000.009	00.05	00.02	00.27	00.34	0.02-	0.05			5
			0837	05					0000	2	5	000.159									5
			0838						0000	2	5	000.203									5
			0840						0000	2	5	000.078									5
			0841						0000	2	5	000.095									5
			0843						0000	2	5	000.021									5
			0844						0000	2	5	000.021									5
			0846						0000	2*	5	000.001-									5
			0847						0000	2*	5	000.009-									5
			0849	12		0317N	16017W		0000	1	5	000.133	00.11	00.07	00.44	00.61	0.03-	0.07			5
			0850						0000	1	5	000.137	00.11	00.07	00.44	00.61	0.03-	0.07			5
			0852						0007	1	5	000.105	00.09	00.04	00.35	00.49	0.02-	0.06			5
			0853						0007	1	5	000.146	00.09	00.04	00.35	00.49	0.02-	0.06			5
			0855						0016	1	5	000.017	00.09	00.07	00.29	00.45	0.02-	0.05			5
			0856						0016	1	5	000.032	00.09	00.07	00.29	00.45	0.02-	0.05			5
			0858						0045	1	5	000.000	00.11	00.05	00.42	00.58	0.01-	0.05			5
			0859						0045	1*	5	000.001-	00.11	00.05	00.42	00.58	0.01-	0.05			5

VE CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1 2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR
NO 67	0019	0861	12	06/12/61	0317N	16017W	017	0074	1	5	000.001	00.09	00.07	00.20	00.36	0.02	0.02			NO67 5
		0862						0074	1	5	000.002	00.09	00.07	00.20	00.36	0.02	0.02			5
		0864						0000	2	5	000.058									5
		0865						0000	2	5	000.064									5
		0867						0000	2	5	000.023									5
		0868						0000	2	5	000.021									5
		0869						0000	2	5	000.007									5
		0870						0000	2	5	000.005									5
		0871						0000	2	5	000.003									5
		0872						0000	2	5	000.015									5
	0020	0876	07	07/12/61	0533N	15946W	016	0000	1	5	000.243	00.01	00.00	00.24	00.25	0.01	0.02			5
		0877						0000	1	5	000.260	00.01	00.00	00.24	00.25	0.01	0.02			5
		0879						0007	1	5	000.187	00.07	00.05	00.03	00.14	0.01	0.03			5
		0880						0007	1	5	000.138	00.07	00.05	00.03	00.14	0.01	0.03			5
		0882						0016	1	5	000.064	00.03	00.00	00.15	00.19	0.00	0.03			5
		0883						0016	1	5	000.046	00.03	00.00	00.15	00.19	0.00	0.03			5
		0885						0045	1	5	000.028	00.09	00.04	00.33	00.46	0.01-	0.05			5
		0886						0045	1	5	000.036	00.09	00.04	00.33	00.46	0.01-	0.05			5
		0888						0074	1	5	000.014	00.05	00.03	00.22	00.30	0.00	0.04			5
		0889						0074	1	5	000.012	00.05	00.03	00.22	00.30	0.00	0.04			5
		0891						0000	2	5	000.108									5
		0892						0000	2	5	000.145									5
		0894						0000	2	5	000.082									5
		0895						0000	2	5	000.063									5
		0897						0000	2	5	000.030									5
		0898						0000	2	5	000.029									5
		0900						0000	2	5	000.067									5
		0901						0000	2	5	000.043									5
		0903	12		0639N	15952W		0000	1	5	000.055	00.04	00.01	00.25	00.30	0.02-	0.05			5
		0904						0000	1	5	000.062	00.04	00.01	00.25	00.30	0.02-	0.05			5
		0906						0005	1	5	000.081	00.00	00.01-	00.07	00.07	0.01-	0.03			5
		0907						0005	1*	5	020.564	00.00	00.01-	00.07	00.07	0.01-	0.03			5
		0909						0019	1*	5	036.490-	00.07	00.00	00.49	00.56	0.01-	0.06			5
		0910						0019	1*	5	036.501-	00.07	00.00	00.49	00.56	0.01-	0.06			5
		0912						0038	1	5	000.004	00.05	00.01-	00.21	00.25	0.00	0.03			5
		0913						0038	1	5	000.026	00.05	00.01-	00.21	00.25	0.00	0.03			5
		0915						0063	1	5	000.077	00.21	00.11	00.59	00.91	0.01	0.07			5
		0916						0063	1*	5	000.012-	00.21	00.11	00.59	00.91	0.01	0.07			5
		0918						0000	2	5	000.021									5
		0919						0000	2	5	000.038									5
		0921						0000	2	5	000.015									5
		0922						0000	2	5	000.006									5
		0923						0000	2	5	000.010									5
		0924						0000	2*	5	000.001-									5
		0925						0000	2	5	000.012									5
		0926						0000	2*	5	000.002-									5
	0021	0930	07	08/12/61	0919N	16000W	017	0000	1	5	000.122	00.00	00.01-	00.01	00.00	0.01	0.00			5
		0931						0000	1	5	000.124	00.00	00.01-	00.01	00.00	0.01	0.00			5
		0933						0005	1	5	000.040	00.04	00.01	00.26	00.31	0.02-	0.05			5
		0934						0005	1	5	000.007	00.04	00.01	00.26	00.31	0.02-	0.05			5
		0936						0019	1	5	000.023	00.01	00.00	00.06	00.06	0.01-	0.03			5
		0937						0019	1	5	000.043	00.01	00.00	00.06	00.06	0.01-	0.03			5

VE CR STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1 2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR
NO 67 0021	0939	07	08/12/61	0919N	16000W	017	0038	1*	5	000.002-	00.04	00.02	00.25	00.31	0.01-	0.05			N067 5
	0940						0038	1*	5	000.015-	00.04	00.02	00.25	00.31	0.01-	0.05			5
	0942						0063	1	5	000.015	00.02	00.04	00.28	00.34	0.01-	0.07			5
	0943						0063	1	5	000.021	00.02	00.04	00.28	00.34	0.01-	0.07			5
	0945						0000	2	5	000.061									5
	0946						0000	2	5	000.018									5
	0948						0000	2	5	000.018									5
	0949						0000	2	5	000.046									5
	0951						0000	2	5	000.010									5
	0952						0000	2*	5	000.009-									5
	0954						0000	2	5	000.018									5
	0955						0000	2	5	000.018									5
	0957	12		1016N	15957W	052	0000	1	5	000.033	00.04	00.01	00.17	00.22	0.02-	0.05			5
	0958						0000	1	5	000.061	00.04	00.01	00.17	00.22	0.02-	0.05			5
	0960						0005	1	5	000.011	00.04	00.02	00.19	00.24	0.01-	0.06			5
	0961						0005	1*	5	000.019-	00.04	00.02	00.19	00.24	0.01-	0.06			5
	0963						0026	1*	5	000.007-	00.02	00.00	00.27	00.28	0.04-	0.06			5
	0964						0026	1	5	000.002	00.02	00.00	00.27	00.28	0.04-	0.06			5
	0966						0058	1*	5	000.002-	00.05	00.01	00.22	00.28	0.00	0.04			5
	0967						0058	1*	5	000.018-	00.05	00.01	00.22	00.28	0.00	0.04			5
	0969						0082	1*	5	000.002-	00.10	00.07	00.48	00.64	0.01-	0.07			5
	0970						0082	1	5	000.009	00.10	00.07	00.48	00.64	0.01-	0.07			5
	0972						0000	2	5	000.020									5
	0973						0000	2*	5	000.002-									5
	0975						0000	2*	5	000.003-									5
	0976						0000	2	5	000.012									5
	0977						0000	2*	5	000.001-									5
	0978						0000	2*	5	000.004-									5
	0979						0000	2	5	000.011									5
	0980						0000	2	5	000.001									5
0022	0984	07	09/12/61	1303N	15953W		0000	1	5	000.087									5
	0985						0000	1	5	000.107									5
	0987						0005	1	5	000.054									5
	0988						0005	1	5	000.036									5
	0990						0026	1	5	000.012									5
	0991						0026	1	5	000.014									5
	0993						0058	1	5	000.024									5
	0994						0058	1*	5	000.015-									5
	0996						0082	1	5	000.008									5
	0997						0082	1	5	000.027									5
	0999						0000	2*	5	000.050-									5
	1000						0000	2*	5	000.043-									5
	1002						0000	2	5	000.009									5
	1003						0000	2	5	000.040									5
	1005						0000	2	5	000.013									5
	1006						0000	2	5	000.012									5
	1008						0000	2	5	000.073									5
	1009						0000	2	5	000.109									5
0023	1011	12		1400N	16000W	053	0000	1	5	000.058	00.01	00.02-	00.17	00.16	0.02-	0.03			5
	1012						0000	1	5	000.052	00.01	00.02-	00.17	00.16	0.02-	0.03			5
	1017	07	10/12/61	1615N	16016W		0000	1	5	000.004	00.17	00.16	00.74	01.07	0.08-	0.17			5
	1018						0000	1	5	000.008	00.17	00.16	00.74	01.07	0.08-	0.17			5

VE	CR	STA	NUM	H	D M Y	LAT	LONG	MS	DPTH	1	2	3	PROD	CHL A	CHL B	CHL C	TOTAL	NAS	AS	LT	%	VECR
NO	67	0023	1020	07	10/12/61	1615N	16016W	053	0005	1		5	000.066	00.04	00.00	00.05	00.09	0.00	0.04			N067 5
			1021						0005	1		5	000.057	00.04	00.00	00.05	00.09	0.00	0.04			5
			1023						0026	1		5	000.040	00.09	00.06	00.32	00.47	0.02-	0.08			5
			1024						0026	1		5	000.051	00.09	00.06	00.32	00.47	0.02-	0.08			5
			1026						0058	1		5	000.025	00.03	00.02	00.11	00.15	0.02	0.03			5
			1027						0058	1		5	000.013	00.03	00.02	00.11	00.15	0.02	0.03			5
			1029						0082	1		5	000.008	00.09	00.09	00.27	00.45	0.01-	0.06			5
			1030						0082	1		5	000.015	00.09	00.09	00.27	00.45	0.01-	0.06			5
		0024	1032	12		1700N	16000W		0000	1		5	000.070	00.02	00.01	00.06-	00.03-	0.02	0.01			5
			1033						0000	1		5	000.051	00.02	00.01	00.06-	00.03-	0.02	0.01			5
			1035	13					0003	1		5	000.045	00.04	00.05	00.04	00.14	0.01-	0.04			5
			1036						0003	1		5	000.075	00.04	00.05	00.04	00.14	0.01-	0.04			5
			1038						0029	1		5	000.005	00.04	00.03	00.12-	00.04-	0.02	0.02			5
			1039						0029	1		5	000.003	00.04	00.03	00.12-	00.04-	0.02	0.02			5
			1041						0046	1		5	000.005	00.11	00.07	00.53	00.71	0.03-	0.10			5
			1042						0046	1		5	000.013	00.11	00.07	00.53	00.71	0.03-	0.10			5
			1044						0088	1		5	000.002	00.04	00.06	00.04	00.14	0.01	0.04			5
			1045						0088	1		5	000.000	00.04	00.06	00.04	00.14	0.01	0.04			5
		0025	1047	07	11/12/61	1853N	15953W	052	0000	1		5	000.100	00.09	00.08	00.35	00.52	0.01-	0.07			5
			1048						0000	1		5	000.145	00.09	00.08	00.35	00.52	0.01-	0.07			5
			1050						0003	1		5	000.108	00.02	00.01	00.04-	00.00	0.03	0.01			5
			1051						0003	1		5	000.066	00.02	00.01	00.04-	00.00	0.03	0.01			5
			1053						0029	1		5	000.051	00.04	00.01	00.10	00.15	0.02	0.01			5
			1054						0029	1		5	000.037	00.04	00.01	00.10	00.15	0.02	0.01			5
			1056						0046	1*		5	000.007-	00.01	00.00	00.22	00.22	0.02	0.01			5
			1057						0046	1*		5	000.011-	00.01	00.00	00.22	00.22	0.02	0.01			5
			1059	08					0088	1*		5	000.187-	00.14	00.10	00.30	00.53	0.00	0.05			5
			1060						0088	1*		5	000.145-	00.14	00.10	00.30	00.53	0.00	0.05			5
			1062	14		2000N	16000W	089	0000	1*		5	000.037-	00.05	00.04	00.06	00.15	0.01-	0.03			5
			1063						0000	1*		5	000.055-	00.05	00.04	00.06	00.15	0.01-	0.03			5
			1065						0007	1		5	000.010	00.04	00.03	00.02	00.09	0.01-	0.02			5
			1066						0007	1		5	000.016	00.04	00.03	00.02	00.09	0.01-	0.02			5
			1068						0026	1*		5	000.046-	00.09	00.09	00.27	00.45	0.07-	0.12			5
			1069						0026	1*		5	000.036-	00.09	00.09	00.27	00.45	0.07-	0.12			5
			1071						0048	1		5	000.004	00.04	00.05	00.12	00.21	0.01-	0.04			5
			1072						0048	1		5	000.021	00.04	00.05	00.12	00.21	0.01-	0.04			5
			1074						0089	1*		5	000.003-	00.07	00.04	00.06	00.17	0.01-	0.04			5
			1075						0089	1*		5	000.018-	00.07	00.04	00.06	00.17	0.01-	0.04			5

TABLE V. Zooplankton caught on the "Rehoboth" Cruise of November-December 1961, NO67. The data are from 150 meter vertical hauls with a conical net 45 centimeters in diameter. The mesh size was approximately .3 mm.

Sta. No.	Latitude	Longitude	Sample time	Settling vol. in ml	Displacement vol. in ml	Wet weight in mg
1	19°58.8'N	179°58.9'W	06:45	1.6	0.2	249
2	19°56' N	179°59' W	11:45	1.8	0.3	181
3	16°54.2'N	179°02.3'E	06:15	3.4	0.3	360
4	16°54' N	179°02.5'E	11:45	3.5	0.5	387
5	14°12' N	179°51' W	06:05	4.5	0.5	470
6	14°17' N	179°52' E	11:45	3.6	0.5	570
7	11°02' N	179°58' W	06:40	3.0	0.5	336
8	11°02' N	179°58' W	11:05	3.5	0.5	429
9	08°15' N	179°50' W	05:45	1.7	0.4	203
10	08°15.6'N	179°50.8'W	11:15	2.2	0.5	432
11	05°14.5'N	179°56.8'W	07:00	5.0	0.5	690
12	05°14.5'N	179°56.8'W	10:55	4.2	0.8	497
13	01°57.8'N	179°45.7'E	06:05	13.7	2.4	2500
14	01°57.8'N	179°45.7'E	12:00	10.0	2.2	2074
15	00°56.5'S	179°57.6'W	07:45	33.0	5.1	4825
16	00°56.5'S	179°57.6'W	11:30	25.0	6.2	6460
17	04°00' S	179°59' W	07:20	7.0	1.1	1003
18	04°00' S	179°59' W	11:45	11.8	1.9	2086
19	05°55.5'S	179°54.6'W	06:00	3.4	0.5	389
20	07°03' S	179°59.5'W	11:45	6.3	0.9	890
21	09°59' S	179°57.5'W	06:10	5.5	0.6	546
22	11°21' S	180°00' W	11:30	3.8	0.4	358
23	12°59' S	173°20' W	11:10	2.9	0.4	329
24	10°05' S	160°06' W	06:30	7.5	1.4	1339
25	09°15' S	160°05' W	11:45	5.3	1.0	888
26	07°00' S	160°00' W	06:30	9.6	1.8	1793
27	06°21' S	160°09' W	11:30	6.2	0.9	887
28	04°00' S	160°00' W	06:25	7.0	1.5	1348
29	03°33.3'S	160°18.8'W	12:15	10.8	2.4	2388
30	01°00' S	160°00' W	06:20	16.5	4.2	3615
31	00°07' S	160°05' W	12:20	18.2	4.6	4620
32	02°00' N	160°00' W	05:45	9.0	1.8	1787
33	03°16.8'N	160°17' W	12:15	7.6	1.0	539
34	05°33' N	159°46' W	07:15	19.4	3.0	3094
35	06°39' N	159°52' W	12:20	6.4	1.2	1383
36	09°19.2'N	160°00' W	07:15	3.7	0.6	614
37	10°16' N	159°57' W	12:30	6.4	0.9	874
38	13°03' N	159°53' W	07:10	7.5	1.3	1135
39	16°15.2'N	160°16' W	07:30	4.8	1.0	586
40	17°00' N	160°00' W	13:00	7.1	1.7	1954
41	18°53' N	159°53' W	07:25	5.2	0.8	733
42	20°00' N	160°00' W	13:15	4.0	0.6	543

TABLE VI. Hydrographic data from the Rehoboth cruise (N067).

Station[1]	Depth(m)	Salinity(°/oo)	O_2(ml/l)	Temp.(°C)	PO_4-P(µgA/l)
0001	0000	34.84	4.32	27.02	0.20
	0010	34.85	4.40	27.10	0.16
	0020	34.86	4.31	27.01	0.25
	0030	34.85	4.40	27.02	0.19
	0049	34.85	4.45	26.99	0.45
	0074	34.86	4.33	27.02	0.35
	0099	35.17	4.08	25.86	0.16
	0148	35.17	4.10	22.01	0.35
	0197	34.94	3.93	19.16	0.44
0002	0000	34.78	4.32	27.10	0.36
	0009	34.77	4.46	27.11	0.38
	0018	34.78	4.30	27.10	0.37
	0027	34.79	4.35	27.10	0.42
	0046	34.78	4.38	27.10	0.28
	0069	34.80	4.32	27.08	0.35
	0092	34.87	3.91	26.69	0.30
	0139	35.19	4.24	23.31	0.35
	0186	35.10	4.13	20.26	0.41
0003	0000	34.71	4.34	27.53	0.55
	0009	34.71	4.31	27.57	0.40
	0019	34.71	4.02	27.54	0.65
	0028	34.72	4.34	27.52	0.62
	0047	34.71	4.32	27.53	0.53
	0071	34.72	4.33	27.52	0.48
	0094	34.74	4.49	26.60	0.35
	0141	34.81	4.10	22.52	0.72
	0188	34.71	3.83	17.56	1.11
0004	0000	34.73	3.92	27.43	0.38
	0009	34.72	4.30	27.50	0.34
	0018	34.73	3.10	27.41	0.30
	0027	34.72	3.05	27.41	0.33
	0044	34.74	3.17	27.40	0.45
	0066	34.73	3.65	27.36	0.64
	0088	34.74	4.58	26.16	0.46
	0132	34.90	3.90	21.48	0.56
	0176	34.40	2.89	13.53	1.64

Station[1]	Depth(m)	Salinity(°/oo)	O_2(ml/l)	Temp.(°C)	PO_4-P(µgA/l)
0005	0000	33.70	4.21	28.57	0.38
	0010	33.69	4.26	28.64	0.36
	0020	33.70	4.19	28.59	0.48
	0030	33.72	4.25	28.62	0.46
	0050	33.78	4.31	28.67	0.49
	0075	33.86	4.32	28.72	0.43
	0100	34.67	4.32	27.01	0.56
	0149	34.52	3.46	16.44	1.33
	0199	34.57	0.57	11.18	2.95
0006	0000	34.38	4.21	28.90	0.42
	0009	34.38	4.23	28.92	0.43
	0018	34.38	4.15	28.88	0.34
	0027	34.37	4.21	28.88	0.46
	0046	34.39	4.21	28.91	0.44
	0069	34.65	4.22	28.73	0.48
	0092	34.96	4.08	28.26	0.55
	0140	34.98	3.41	26.17	0.82
	0188	34.79	3.05	18.52	0.65
0007	0000	35.09	4.40	27.94	0.53
	0005	35.09	4.37	28.00	0.55
	0011	35.09	4.34	27.96	0.50
	0016	35.12	4.34	27.94	0.58
	0025	35.11	4.38	27.94	0.55
	0041	35.16	4.28	27.74	0.63
	0055	35.18	4.15	27.46	0.95
	0084	35.22	4.32	27.42	0.70
	0116	35.14	3.72	26.77	0.83
	0149	34.87	3.26	22.74	0.93
	0184	34.70	2.90	16.02	1.45
	0196	34.83	2.84	11.88	1.88
0008	0000	35.31	4.24	27.91	0.65
	0007	35.30	4.27	27.85	0.71
	0013	35.31	4.24	27.73	0.95
	0019	35.31	4.27	27.72	0.70
	0032	35.31	4.29	27.72	0.64
	0048	35.31	4.16	27.66	0.60
	0063	35.32	4.04	27.64	0.73
	0095	35.32	4.09	27.60	0.78
	0128	35.39	3.87	27.48	0.83
	0161	35.90	2.80	23.88	1.14
	0195	35.31	2.96	17.88	1.33

Station[1/]	Depth(m)	Salinity(°/oo)	O_2(ml/l)	Temp.(°C)	PO_4-P(µgA/l)
0009	0000	35.50	4.05	29.17	0.59
	0010	35.52	4.22	29.17	0.54
	0020	35.50	3.71	29.10	0.57
	0030	35.50	2.57	29.12	0.59
	0050	35.49	4.27	29.10	0.56
	0075	35.54	3.31	28.84	0.65
	0100	35.50	3.16	28.45	0.77
	0150	35.95	3.40	26.55	0.96
	0200	35.82	2.73	20.34	1.20
0010	0000	35.11	4.31	29.26	0.49
	0010	35.08	4.30	29.27	0.48
	0020	35.12	4.20	29.25	0.40
	0030	35.29	4.34	29.26	0.53
	0050	35.34	4.45	29.24	0.52
	0075	35.47	4.36	29.05	0.57
	0100	35.48	4.15	28.56	0.70
	0150	36.00	3.22	25.58	1.10
	0200	35.83	3.17	20.90	1.17
0011	0000	34.73	----	29.02	0.48
	0010	34.77	3.51	29.03	0.51
	0020	34.80	4.23	28.92	0.45
	0030	34.72	4.47	28.90	0.50
	0050	34.82	4.27	28.88	0.52
	0075	35.31	4.20	28.52	0.54
	0100	35.48	3.92	27.92	0.65
	0150	36.02	3.22	24.43	0.99
	0200	35.82	3.34	20.96	1.44
0012	0000	34.78	4.27	28.24	0.48
	0010	34.87	4.25	28.16	0.45
	0020	35.02	4.20	28.20	0.47
	0030	35.04	4.25	28.19	0.44
	0050	35.05	4.43	27.90	0.73
	0074	35.27	4.28	27.57	0.53
	0099	35.54	1.65	26.76	0.50
	0149	35.93	3.67	25.19	0.71
	0198	35.95	3.35	21.86	0.98
0014	0000	35.39	4.19	28.28	0.50
	0010	35.38	4.18	28.27	0.51
	0019	35.40	4.16	28.26	0.43
	0029	35.42	4.21	28.26	0.47
	0048	35.50	4.21	28.22	0.48
	0072	35.63	4.27	27.96	0.49
	0096	35.85	4.18	27.11	0.50
	0154	36.34	3.75	25.67	0.62
	0192	36.24	3.48	23.13	0.87

Station[1/]	Depth(m)	Salinity(°/oo)	O_2(ml/l)	Temp.(°C)	PO4-P(µgA/l)
0015	0000	35.51	4.28	28.38	0.55
	0009	35.52	4.21	28.40	0.56
	0018	35.52	4.20	28.40	0.62
	0026	35.52	4.29	28.40	0.54
	0044	35.53	4.30	28.44	0.48
	0066	35.55	4.32	28.38	0.50
	0088	35.94	4.29	28.16	0.53
	0133	36.30	4.00	26.28	0.64
	0177	36.29	3.69	23.80	0.86
0016	0000	35.67	4.28	28.08	0.72
	0009	35.67	4.25	28.09	0.74
	0017	35.68	4.31	28.06	0.67
	0026	35.68	4.28	28.06	0.96
	0044	35.69	4.32	28.10	0.73
	0066	35.69	4.30	28.07	0.75
	0088	35.70	4.27	28.10	0.70
	0132	35.96	3.97	27.34	1.31
	0178	36.21	3.57	23.93	0.99
0017	0000	35.66	4.28	27.36	0.78
	0006	35.67	4.26	27.38	0.81
	0012	35.66	4.26	27.34	0.76
	0019	35.65	4.26	27.34	0.78
	0031	35.64	4.33	27.32	0.84
	0046	35.60	4.35	27.06	0.87
	0061	35.59	4.35	27.02	0.89
	0092	35.58	4.33	26.90	0.93
	0123	35.55	4.11	26.14	1.01
	0153	35.81	3.69	24.76	1.05
	0185	35.59	4.35	-----	0.85
0018	0000	35.24	4.30	26.18	0.91
	0013	35.25	4.30	26.21	0.90
	0031	35.25	4.22	26.16	0.85
	0047	35.27	4.31	26.20	0.89
	0062	35.27	4.24	26.20	0.87
	0093	35.32	4.24	26.26	0.92
	0123	35.53	3.97	25.90	1.03
	0153	35.82	3.15	22.08	1.35
	0183	35.26	2.76	16.04	1.66
0019	0000	34.99	4.37	27.20	0.70
	0007	34.99	4.49	27.23	0.75
	0015	34.99	4.39	27.16	0.71
	0029	35.01	4.24	26.62	0.84
	0039	35.01	3.82	26.47	0.87
	0066	34.98	3.60	25.78	0.97
	0080	34.96	3.84	25.65	0.96
	0136	34.82	2.54	19.24	1.54
	0168	34.68	2.33	13.75	2.07

Station[1]	Depth(m)	Salinity(°/oo)	O_2(ml/l)	Temp.(°C)	PO_4-P(ugA/l)
0020	0000	34.98	4.35	27.04	0.70
	0009	34.98	4.30	27.05	0.72
	0018	34.98	4.30	27.04	0.73
	0027	34.98	4.31	27.03	0.64
	0045	34.98	4.31	26.96	0.71
	0067	35.00	4.25	26.91	0.76
	0090	35.06	4.26	26.24	0.93
	0135	35.12	4.17	26.02	0.91
	0180	35.02	3.87	24.87	1.11
0021	0000	33.88	4.22	28.05	0.58
	0010	33.93	4.34	28.12	0.53
	0020	34.00	4.28	28.11	0.48
	0030	34.03	4.26	28.14	0.54
	0050	34.38	4.28	28.21	0.51
	0075	34.62	4.27	27.32	0.56
	0100	34.69	3.83	24.19	0.71
	0150	34.53	2.74	16.30	1.72
	0200	34.59	1.24	10.79	2.71
0022	0000	34.18	4.33	27.20	0.62
	0009	34.17	4.33	27.20	0.53
	0018	34.17	4.27	27.22	0.57
	0027	34.19	4.36	27.12	0.54
	0046	34.33	4.36	27.14	0.50
	0069	34.60	4.71	23.64	0.56
	0092	34.64	3.80	19.62	0.98
	0138	34.67	2.71	12.34	0.90
	0184	34.70	3.19	11.33	0.34
0023	0000	33.96	4.49	26.11	0.56
	0006	33.97	4.52	26.11	0.57
	0012	33.96	4.57	26.05	0.54
	0018	33.96	4.44	25.96	0.56
	0028	34.08	4.48	25.96	0.59
	0043	34.40	4.48	26.02	0.62
	0058	34.80	4.88	23.62	0.53
	0087	34.99	4.57	21.92	0.59
	0118	34.96	4.18	19.67	0.79
	0148	34.81	4.17	17.65	0.77
	0180	34.31	3.74	13.29	1.39
0024	0000	34.71	4.60	25.36	0.50
	0013	34.71	4.56	25.39	0.51
	0020	34.70	4.50	25.39	0.41
	0033	34.70	4.55	25.37	0.55
	0066	34.84	4.54	25.44	0.53
	0134	34.81	4.51	23.68	0.62
	0169	35.00	4.35	21.94	0.63
	0204	35.02	4.10	19.81	0.75

Station[1/]	Depth(m)	Salinity($^o/oo$)	O_2(ml/l)	Temp.(^oC)	PO_4-P(ugA/l)
0025	0000	34.88	4.54	25.32	0.50
	0010	34.88	4.55	25.33	0.48
	0020	34.89	4.44	25.33	0.49
	0029	34.89	4.57	25.32	0.53
	0048	34.89	4.55	25.30	0.56
	0072	34.91	4.57	25.30	0.51
	0096	34.90	4.52	25.32	0.53
	0144	34.97	4.25	21.66	0.67
	0192	34.91	4.03	18.90	0.83

1/ Station positions are shown in Table II.

TABLE VII. Nitrate analyses from the Rehoboth cruise (N067).

Station	Date	Depth	Latitude	Longitude	NO_3-N(µA/l)
0001	11/17/61	0000	19°56'N	179°57'W	0.24
		0016			0.23
		0024			0.15
		0030			0.74
		0040			0.44
0002	11/18/61	0000	16°54'N	179°03'E	0.00
		0004			0.00
		0024			0.00
		0060			0.00
		0102			0.00
0003	11/19/61	0000	14°12'N	179°51'W	0.00
		0004			0.09
		0024			0.13
		0060			0.00
		0102			0.00
0004	11/20/61	0000	11°02'N	179°58'W	0.00
		0004			0.36
		0010			0.00
		0054			0.00
		0099			0.00
0005	11/21/61	0000	08°15'N	179°50'W	0.00
		0014			0.00
		0028			0.00
		0066			0.00
		0105			0.21
0006	11/22/61	0000	05°15'N	179°57'W	0.09
		0006			0.00
		0031			0.00
		0062			0.00
		0092			0.00
0007	11/23/61	0000	01°58'N	179°46'E	0.69
		0006			1.05
		0031			1.37
		0062			2.61
		0092			3.92
0008	11/24/61	0000	00°57'S	179°58'W	1.94
		0008			1.84
		0023			3.09
		0037			1.95
		0058			2.57

Station	Date	Depth	Latitude	Longitude	NO_3-N(µA/l)
0009	11/25/61	0000	04°00'S	179°59'W	0.41
		0010			0.20
		0028			1.82
		0035			0.61
		0059			1.53
0010	11/26/61	0000	05°56'S	179°55'W	0.25
		0007			0.17
		0041			0.19
		0066			0.40
		0087			1.58
0011	11/27/61	0000	09°59'S	179°58'W	0.27
		0006			0.00
		0033			0.00
		0064			0.14
		0095			0.00
0014	11/29/61	0000	12°59'S	173°20'W	0.00
		0009			0.00
		0023			0.29
		0062			0.00
		0096			0.00
0015	12/2/61	0000	10°05'S	160°06'W	0.30
		0009			0.00
		0023			0.29
		0062			0.00
		0096			0.60
		0000	09°15'S	160°05'W	0.00
		0009			0.00
		0032			0.75
		0059			0.00
		0099			0.00
0016	12/3/61	0000	07°00'S	160°00'W	0.00
		0009			0.00
		0032			0.00
		0059			0.00
		0099			0.38
		0000	06°21'S	160°09'	0.00
		0008			0.57
		0028			1.56
		0035			1.54
		0087			0.25
0017	12/4/61	0000	04°00'S	160°00'W	2.92
		0008			2.50
		0028			2.40
		0035			3.60
		0087			3.34

Station	Date	Depth	Latitude	Longitude	NO_3-N(µA/l)
0017	12/4/61	0000	03°33'S	160°19'W	0.15
		0007			3.56
		0029			1.55
		0052			3.44
		0081			2.79
0018	12/5/61	0000	01°00'S	160°00'W	4.98
		0007			4.10
		0029			2.81
		0052			3.69
		0081			4.26
		0000	00°07'S	160°05'W	0.99
		0007			1.99
		0021			0.73
		0034			3.15
		0070			2.97
0019	12/6/61	0000	02°00'N	160°00'W	1.38
		0007			1.13
		0021			1.31
		0034			1.86
		0070			3.58
		0000	03°17'N	160°17'W	0.00
		0007			0.00
		0016			0.00
		0045			0.00
		0074			1.22
0020	12/7/61	0000	05°33'N	159°46'W	0.17
		0007			0.68
		0016			0.15
		0045			0.33
		0074			2.10
		0000	06°39'N	159°52'W	0.21
		0005			0.19
		0019			0.13
		0038			0.19
		0063			0.70
0021	12/8/61	0000	09°19'N	160°00'W	0.14
		0005			0.30
		0019			0.14
		0038			0.25
		0063			0.14
		0000	10°16'N	159°57'W	0.23
		0005			0.36
		0026			0.27
		0058			0.91
		0082			4.35

Station	Date	Depth	Latitude	Longitude	NO_3-N(μA/l)
0022	12/9/61	0000	13°03'N	159°53'W	0.10
		0005			0.32
		0026			0.23
		0058			0.24
		0082			0.28
0023	12/9/61	0000	14°00'N	160°00'W	0.14
	12/10/61	0000	16°15'N	160°16'W	0.00
		0005			0.00
		0026			0.00
		0058			0.00
		0082			0.00
0024	12/10/61	0000	17°00'N	160°00'W	0.00
		0003			0.09
		0029			0.18
		0046			0.19
		0088			0.17
0025	12/11/61	0000	18°53'N	159°53'W	0.00
		0003			0.00
		0029			0.32
		0046			0.48
		0088			0.19
		0000	20°00'N	160°00'W	0.23
		0007			0.10
		0026			0.23
		0048			0.14
		0089			0.18

APPENDIX II

(1964)

Description and Analysis of Miscellaneous

Technique Evaluation Experiments

by Jan Newhouse

As completed in the Botany Department

of the University of Hawaii

Work done under contract AT-(04-3)-15 with the U. S. Atomic Energy Commission

Introduction

This section consists of two parts, the first a presentation of results from experimental work performed under this contract and hereto unreported. The second part is a discussion of our analyses of these data, which emphasizes both conclusions and the need for further work along certain of the same lines. A number of these experiments which were designed to test a particular hypothesis have contributed information to, and opened up other areas of interest. For this reason, brief descriptions and the results of the experiments follow, as Part A, and then, in Part B, there are analyses of the data which draw variously upon the experiments.

EXPERIMENT 1

(Notebook 63: 25-28. June 27-28, 1962)

Procedure: The methods of handling and techniques used in this experiment are common to those which follow unless otherwise noted. In general the method, except as mentioned, is that described as "standard" for the Hawaii Method. The time incubation was begun is referred to as "time in" and the time incubation was terminated is referred to as "time out."

Immediately prior to incubation, surface phytoplankton samples were taken with a newly cleaned plastic bucket from the water adjacent to the diving platforms in the Waikiki Natatorium, Honolulu, Hawaii. These samples were carried in the plastic bucket to the bench laboratory near the natatorium, poured into a five-gallon Pyrex glass carboy and then air was bubbled through them with an air hose and stone. Subsamples were siphoned into 250 ml bottles while the water in the carboy was further agitated manually. The inoculations with stock no. 8 carbon-14 (activity, 5. 15 x 10^6 counts/min.) were all made by one person.

At 06:00 on June 27th, three sets of bottles, two light and one dark per set, were put into an unpainted galvanized iron sunlight incubator which was placed on the roof of the laboratory and fitted with a cooling system of running water. One set of these bottles was removed and filtered (Selman membrane filters AM-5) at 12:00, another at 18:00 of the same day and the last at 06:00 on June 28th.

At 12:00 of the 27th, two similar sets were prepared and treated in the same way with removal, respectively, at 18:00 on the 27th and 12:00 on the 28th.

TABLE I. Mean of two light bottles and, in parenthesis, dark bottles in counts per minute per hour of incubation. Unpainted galvanized iron sunlight incubator. June 27-28, 1962. NB63: 28.

Incubation period	Counts/min./hr.
06:00-12:00	451 (17)
06:00-18:00	737 (21)
06:00-06:00	358 (17)
12:00-18:00	1298 (20)
12:00-12:00	651 (16)

EXPERIMENT 2

(Notebook 68: 11-73. July 14-31, 1962.)

Procedure: As for Experiment 1. The dark bottle data given in Table III are for both this and Experiment 3 for the dates shown.

TABLE II. Mean of two light bottles in counts per minute per hour of incubation. Unpainted galvanized iron sunlight incubator. July 14-31, 1962. NB68: 74-75.

Incubation period	Counts per minute per hour of incubation started on July:																	
	14th	15th	16th	17th	18th	19th	20th	21st	22nd	23rd	24th	25th	26th	27th	28th	29th	30th	31st
06:00-12:00	325	371	231	267	282	172	201	139	210	357	378	194	185	210	330	182	154	230
06:00-18:00	474	569	434	525	381	278	272	351	427	620	601	468	271	434	482	241	282	318
06:00-06:00	213	229	141	94	157	103	143	145	193	262	238	216	132	140	165	112	141	180
12:00-18:00	721	920	459	865	814	356	442	547	717	1093	779	938	810	650	696	712	521	741
12:00-12:00	428	496	371	291	353	275	271	286	473	468	425	431	390	299	292	361	348	431

TABLE III. Dark bottle counts per minute per hour of incubation.
July 14-31, 1962. NB68: 71.

Incubation period	Counts per minute per hour of incubation started on July:																	
	14th	15th	16th	17th	18th	19th	20th	21st	22nd	23rd	24th	25th	26th	27th	28th	29th	30th	31st
06:00-12:00	11	12	16	16	14	13	14	28	12	25	16	14	15	28	16	15	67	15
06:00-18:00	14	14	12	8	17	12	12	16	8	14	11	9	19	14	9	16	12	15
06:00-06:00	9	8	9	9	8	7	11	6	10	8	6	7	10	8	8	11	10	8
12:00-18:00	16	11	17	28	20	15	11	13	18	22	17	16	19	23	21	16	60	21
12:00-12:00	9	17	10	9	25	9	10	8	9	11	8	13	10	11	13	7	4	9

EXPERIMENT 3
(Notebook 68: 24-73. July 20-31, 1962.)

Procedure: As for Experiment 1 except that, for this series, the samples were incubated in a galvanized iron sunlight incubator which was painted black on the inside surfaces. Sample aliquots were drawn from the same carboy as that used for Experiment 2 which was run concurrently. For dark bottle values, use those from Experiment 2.

TABLE IV. Mean of two light bottles in counts per minute per hour of incubation. Black painted galvanized iron sunlight incubator. July 20-31, 1962. NB68: 74-75.

Incubation period	Counts per minute per hour of incubation started on July:											
	20th	21st	22nd	23rd	24th	25th	26th	27th	28th	29th	30th	31st
06:00-12:00	163	159	290	428	449	345	235	309	375	250	188	251
06:00-18:00	273	269	320	659	636	557	273	503	427	354	346	328
06:00-06:00	107	150	171	271	303	277	134	173	232	142	146	211
12:00-18:00	470	531	1020	1194	1354	1054	771	714	664	643	539	866
12:00-12:00	292	381	534	458	385	491	365	372	378	337	300	373

EXPERIMENT 4

(Notebook 68: 76-103, Notebook 70: 2-35. August 15-22, 1962.)

Procedure: As for Experiment 1, with the following modifications.

a. Use of a black painted galvanized iron sunlight incubator.

b. In addition to incubation at full light intensity, aliquot samples were covered with neutral density filters which permitted light penetration of approximately 64%, 30%, 16%, and 1%.

c. Dark bottles were held in a bucket of water in the laboratory.

TABLE V. Mean of two light bottles in counts per minute per hour of incubation. Black painted galvanized iron sunlight incubator. August 15-22, 1962. NB70: 37-39.

Filter type	Incubation period	Counts per minute per hour of incubation started in August:						
		15th	16th	17th	18th	19th	20th	21st
Without neutral density filters	06:00-12:00	298	321	300	254	223	101	119
	06:00-06:00	246	204	203	234	117	110	91
	12:00-18:00	1428	1477	2185	1349	983	630	415
	12:00-12:00	772	664	795	556	677	332	324
64% neutral density filters	06:00-12:00	285	360	337	414	225	145	124
	06:00-06:00	254	198	217	261	94	96	86
	12:00-18:00	1966	1559	2581	1381	1323	704	556
	12:00-12:00	697	649	764	567	550	337	341
30% neutral density filters	06:00-12:00	316	269	284	226	155	112	101
	06:00-06:00	172	131	142	124	92	63	57
	12:00-18:00	1177	1073	2283	1018	669	445	456
	12:00-12:00	502	519	663	411	424	249	261
16% neutral density filters	06:00-12:00	165	133	114	130	109	55	34
	06:00-06:00	78	70	60	75	51	32	28
	12:00-18:00	278	446	741	451	264	211	199
	12:00-12:00	198	178	322	142	181	110	106
1% neutral density filters	06:00-12:00	39	41	43	45	29	28	15
	06:00-06:00	24	19	16	16	15	13	9
	12:00-18:00	65	58	250	47	43	53	35
	12:00-12:00	39	42	67	30	29	24	19

TABLE VI. Dark bottle counts per minute per hour of incubation. August 15-22, 1962. NB70: 37-39.

Incubation period	Counts per minute per hour of incubation started in August:						
	15th	16th	17th	18th	19th	20th	21st
06:00-12:00	11	11	14	12	12	11	8
06:00-06:00	7	6	4	6	6	5	5
12:00-18:00	19	12	24	17	16	12	12
12:00-12:00	6	9	7	6	8	5	8

EXPERIMENT 5

(Notebook 70: 2-35. August 17-22, 1962.)

Procedure: As for Experiment 1, with the following modifications.

a. Use of a 1958-type fluorescent light incubator which was turned off from sunset to sunrise each night.

b. In addition to incubation at full light intensity aliquot samples were covered with neutral density filters which permitted light penetration of approximately 64%, 30%, 16% and 1%.

This experiment was done with aliquots of the same phytoplankton samples used for Experiment 4 which was run concurrently. Dark bottle data, Table VI, are common to both experiments.

TABLE VII. Mean of two light bottles in counts per minute per hour of incubation. 1958-type fluorescent light incubator. August 17-22, 1962. NB70: 37-39.

Filter type	Incubation period	Counts per minute per hour of incubation started in August: 17th	18th	19th	20th	21st
Without neutral density filters	06:00-12:00	351	487	333	229	155
	06:00-06:00	232	373	206	142	139
	12:00-18:00	4692	1709	1217	1048	714
	12:00-12:00	1107	695	614	626	386
64% neutral density filters	06:00-12:00	293	336	228	177	104
	06:00-06:00	173	250	156	126	107
	12:00-18:00	3172	981	1060	639	528
	12:00-12:00	818	628	539	418	265
30% neutral density filters	06:00-12:00	83	140	85	85	47
	06:00-06:00	70	80	55	43	36
	12:00-18:00	726	232	340	190	203
	12:00-12:00	277	204	110	153	78
16% neutral density filters	06:00-12:00	42	60	46	34	19
	06:00-06:00	31	26	20	17	15
	12:00-18:00	203	68	89	47	59
	12:00-12:00	74	58	36	36	20
1% neutral density filters	06:00-12:00	17	19	18	19	12
	06:00-06:00	10	8	10	7	6
	12:00-18:00	51	20	30	18	17
	12:00-12:00	10	15	9	11	6

EXPERIMENT 6
(Notebook 63: 70-89. September 12-13, 1962.)

Procedure: As for Experiment 1, with aliquot phytoplankton samples incubated in both a black painted galvanized iron sunlight incubator and a 1958-type fluorescent light incubator. Lights in the fluorescent incubator were turned off between 18:00 and 06:00.

Inoculations were made with stock no. 9 carbon-14 (activity, 7.26 x 10^6 counts/min.).

TABLE VIII. Mean of two light bottles in counts per minute per hour of incubation. September 12-13, 1962. NB63: 98.

Incubation period	Counts per minute per hour of incubation	
	Sunlight incubator	Fluorescent incubator
06:00-12:00	247	307
06:00-18:00	384	604
06:00-06:00	144	182
12:00-18:00	1401	2206
12:00-12:00	640	786

EXPERIMENT 7

(Notebook 63: 70-89. September 12-13, 1962.)

Procedure: As for Experiment 1, with aliquot phytoplankton samples incubated in both black painted galvanized iron sunlight incubators and 1958-type fluorescent light incubators. The fluorescent lights were not turned off at night, *i.e.*, they were on throughout the entire experimental period.

Inoculations were made with stock no. 9 carbon-14 (activity, 7.26×10^6 counts/min.).

TABLE IX. Mean of two light bottles in counts per minute per hour of incubation. September 12-13, 1962. NB63: 98.

Incubation period	Counts per minute per hour of incubation	
	Sunlight incubator	Fluorescent incubator
06:00-08:00	151	231
07:00-09:00	328	413
08:00-10:00	429	671
09:00-11:00	711	673
10:00-12:00	1179	1581
11:00-13:00	1216	1303
12:00-14:00	1082	1522
13:00-15:00	1840	1851
14:00-16:00	1219	1728
15:00-17:00	1696	1782
16:00-18:00	1067	1963
17:00-19:00	404	1350
18:00-20:00	43	1057
19:00-21:00	19	519
20:00-22:00	19	294
21:00-23:00	21	299
22:00-24:00	17	186
23:00-01:00	28	154
24:00-02:00	37	173
01:00-03:00	35	192
02:00-04:00	18	180
03:00-05:00	18	213
04:00-06:00	19	267
05:00-07:00	56	248
06:00-08:00	131	260
07:00-09:00	322	551
08:00-10:00	450	886
09:00-11:00	665	1507
10:00-12:00	723	1712
11:00-13:00	2100	4029
12:00-14:00	1604	2455

TABLE X. Dark bottle counts per minute per hour of incubation. September 12-13, 1963. NB63: 99.

Incubation period	Counts per minute per hour of incubation	
	Sunlight incubator	Fluorescent incubator
06:00-08:00	11	15
07:00-09:00	11	14
08:00-10:00	13	12
09:00-11:00	15	9
10:00-12:00	13	13
11:00-13:00	3	12
12:00-14:00	10	11
13:00-15:00	5	13
14:00-16:00	15	16
15:00-17:00	57	58
16:00-18:00	30	19
17:00-19:00	19	38
18:00-20:00	21	22
19:00-21:00	18	18
20:00-22:00	16	20
21:00-23:00	18	18
22:00-24:00	14	14
23:00-01:00	16	22
24:00-02:00	16	18
01:00-03:00	14	14
02:00-04:00	21	14
03:00-05:00	17	19
04:00-06:00	22	15
05:00-07:00	14	16
06:00-08:00	14	16
07:00-09:00	13	17
08:00-10:00	15	13
09:00-11:00	19	--
10:00-12:00	32	13
11:00-13:00	41	18
12:00-14:00	19	18

EXPERIMENT 8

(Notebook 70: 41-63. November 10-12, 1962.)

Procedure: As for Experiment 1, with aliquot phytoplankton samples incubated in both unpainted galvanized iron sunlight incubators and 1958-type fluorescent light incubators. The fluorescent lights were not turned off at night for samples being incubated 2 hours, *i.e.*, they were on throughout the entire experimental period. The lights of the incubators which held the bottles being incubated for 24 hours were turned off between 18:00 and 06:00 each day.

Dark bottles were held in a bucket of water in the laboratory for their respective periods of incubation.

Carbon-14, stock no. 8 was used for inoculation of the 06:00 and 08:00 samples on the first day, and stock no. 9 (activity, 7.26×10^6 counts/min.) was used for all other samples but all data presented here have been corrected to stock no. 9 activity. The galvanized iron sunlight incubators were covered each day from 08:00-16:00 with a layer of black nylon net which permitted penetration of 64% of the incident sunlight.

TABLE XI. Mean of two light bottles in counts per minute per hour of incubation. November 10-12, 1962. NB70: 62-63.

Incubation period	Counts per minute per hour of incubation	
	Sunlight incubator	Fluorescent incubator
06:00-08:00	195	391
08:00-10:00	469	696
10:00-12:00	1649	2211
12:00-14:00	1342	1456
14:00-16:00	1750	2454
16:00-18:00	969	2102
18:00-20:00	71	882
20:00-22:00	--	444
22:00-24:00	--	372
24:00-02:00	--	413
02:00-04:00	--	386
04:00-06:00	--	265
06:00-08:00	164	463
08:00-10:00	566	795
10:00-12:00	1133	1371
12:00-14:00	1009	1211
14:00-16:00	999	2023
16:00-18:00	654	2088
18:00-20:00	100	422
20:00-22:00	--	540
22:00-24:00	--	522
24:00-02:00	--	342
02:00-04:00	--	318
04:00-06:00	--	273
06:00-08:00	218	506
08:00-10:00	589	1025
10:00-12:00	1274	1566
12:00-14:00	1551	1942
14:00-16:00	1538	2614
16:00-18:00	846	2601

TABLE XII. Dark bottle counts per minute per hour of incubation. November 10-12, 1962. NB70: 64.

Incubation period	Counts per minute per hour of incubation
06:00-08:00	41
08:00-10:00	33
10:00-12:00	63
12:00-14:00	69
14:00-16:00	54
16:00-18:00	49
18:00-20:00	110
20:00-22:00	214
22:00-24:00	81
24:00-02:00	129
02:00-04:00	53
04:00-06:00	43
06:00-08:00	53
08:00-10:00	38
10:00-12:00	71
12:00-14:00	23
14:00-16:00	61
16:00-18:00	65
18:00-20:00	68
20:00-22:00	144
22:00-24:00	160
24:00-02:00	102
02:00-04:00	37
04:00-06:00	62
06:00-08:00	51
08:00-10:00	63
10:00-12:00	57
12:00-14:00	89
14:00-16:00	64
16:00-18:00	183

TABLE XIII. Mean of two light bottles in counts per minute per hour of incubation. November 10-12, 1962. NB70: 62-63.

Incubation period	Counts per minute per hour of incubation	
	Sunlight incubator	Fluorescent incubator
06:00-06:00	251	295
08:00-08:00	278	460
10:00-10:00	536	953
12:00-12:00	499	837
14:00-14:00	681	940
16:00-16:00	777	1032
18:00-18:00	501	902
20:00-20:00	412	886
22:00-22:00	321	599
24:00-24:00	321	684
02:00-02:00	302	587
04:00-04:00	224	385
06:00-06:00	205	360
08:00-08:00	310	468
10:00-10:00	487	786
12:00-12:00	460	729
14:00-14:00	652	991
16:00-16:00	920	1200
18:00-18:00	716	981

TABLE XIV. Dark bottle counts per minute per hour of incubation. November 10-12, 1962. NB70: 64.

Incubation period	Counts per minute per hour of incubation
06:00-06:00	14
08:00-08:00	11
10:00-10:00	20
12:00-12:00	18
14:00-14:00	15
16:00-16:00	16
18:00-18:00	23
20:00-20:00	21
22:00-22:00	21
24:00-24:00	24
02:00-02:00	12
04:00-04:00	37
06:00-06:00	11
08:00-08:00	16
10:00-10:00	14
12:00-12:00	10
14:00-14:00	23
16:00-16:00	9
18:00-18:00	29

EXPERIMENT 9

(NB70: 80-117. December 21-24, 1962.)

Procedure: As for Experiment 1, with the following modifications.

a. Inoculations were made with stock no. 9 carbon-14 (activity, 7.26×10^6 counts/min.).

b. Samples taken every two hours and incubated for two hours in both the unpainted galvanized sunlight incubators (A1) and the 1958-type fluorescent light incubators (A2). Table XV.

c. Samples taken every two hours and incubated for 24 hours in the unpainted galvanized sunlight incubators (B). Table XVI.

d. Samples taken every two hours and held in unpainted galvanized sunlight incubators until the first following 14:00, at which time they were inoculated and immediately incubated for two hours in the same incubators (C). Table XVII.

e. Samples (approximately 150 liters) taken at about 13:00-14:00 and held in an exposed 2' x 2' x 5' white fiber glass tub on the laboratory roof. Aliquots were withdrawn from this tub every two hours, inoculated, and immediately incubated for two hours in the unpainted galvanized sunlight incubators (D). Table XVIII.

f. Dark bottles were held in a bucket of water in the laboratory for their respective periods of incubation. Table XIX.

g. Samples taken every two hours for determination of dry weight (E) and pigment content (F). Table XX.

TABLE XV. Mean of two light bottles in counts per minute per hour of incubation. December 22-24, 1962. NB71: 5.

Incubation period	Counts per minute per hour of incubation	
	Sunlight incubator (A1)	Fluorescent incubator (A2)
06:00-08:00	190	222
08:00-10:00	286	657
10:00-12:00	205	1079
12:00-14:00	542	1085
14:00-16:00	650	1200
16:00-18:00	648	985
18:00-20:00	28	520
20:00-22:00	49	309
22:00-24:00	37	298
24:00-02:00	28	251
02:00-04:00	35	302
04:00-06:00	21	363
06:00-08:00	158	440
08:00-10:00	517	704
10:00-12:00	242	961
12:00-14:00	458	930
14:00-16:00	450	1298
16:00-18:00	819	1698
18:00-20:00	29	622
20:00-22:00	33	231
22:00-24:00	29	215
24:00-02:00	26	251
02:00-04:00	29	277
04:00-06:00	37	328
06:00-08:00	108	437
08:00-10:00	483	604
10:00-12:00	659	1345
12:00-14:00	453	1385
14:00-16:00	533	2400
16:00-18:00	1104	1690

TABLE XVI. Mean of two light bottles in counts per minute per hour of incubation. Unpainted galvanized iron sunlight incubator. December 22-24, 1962. NB71: 5.

Incubation period	Counts per minute per hour of incubation (B)
06:00-06:00	165
08:00-08:00	181
10:00-10:00	261
12:00-12:00	323
14:00-14:00	344
16:00-16:00	436
18:00-18:00	410
20:00-20:00	306
22:00-22:00	252
24:00-24:00	277
02:00-02:00	123
04:00-04:00	124
06:00-06:00	172
08:00-08:00	163
10:00-10:00	150
12:00-12:00	377
14:00-14:00	482
16:00-16:00	781
18:00-18:00	625

TABLE XVII. Mean of two light bottles in counts per minute per hour of incubation. Unpainted galvanized iron sunlight incubator. December 22-24, 1962. NB71: 5.

Sample time and date		Incubation period		Counts per minute per hour of incubation (C)
06:00	12/22	14:00-16:00	12/22	761
08:00		"		613
10:00		"		777
12:00		"		676
14:00		"		---
16:00		14:00-16:00	12/23	917
18:00		"		478
20:00		"		1025
22:00		"		1030
24:00		"		623
02:00	12/23	"		509
04:00		"		450
06:00		"		469
08:00		"		548
10:00		"		323
12:00		"		436
14:00		"		---
16:00		14:00-16:00	12/24	1372
18:00		"		1018
20:00		"		573
22:00		"		743
24:00		"		450
02:00	12/24	"		605
04:00		"		518
06:00		"		564
08:00		"		520
10:00		"		490
12:00		"		234

TABLE XVIII. Mean of two light bottles in counts per minute per hour of incubation. Unpainted galvanized incubator. December 21-24, 1962. NB71: 5.

Sample time and date	Incubation period	Counts per minute per hour of incubation (D)
14:00 12/21	06:00-08:00 12/22	327
"	08:00-10:00	491
"	10:00-12:00	339
"	12:00-14:00	693
"	14:00-16:00	822
13:00-13:40 12/22	16:00-18:00	1059
"	18:00-20:00	42
"	20:00-22:00	51
"	22:00-24:00	52
"	24:00-02:00	51
"	02:00-04:00 12/23	62
"	04:00-06:00	53
"	06:00-08:00	273
"	08:00-10:00	1263
"	10:00-12:00	939
"	12:00-14:00	1094
"	14:00-16:00	958
13:00-13:40 12/23	16:00-18:00	1073
"	18:00-20:00	35
"	20:00-22:00	35
"	22:00-24:00	40
"	24:00-02:00	62
"	02:00-04:00 12/24	50
"	04:00-06:00	47
"	06:00-08:00	281
"	08:00-10:00	1038
"	10:00-12:00	1683
"	12:00-14:00	1598
"	14:00-16:00	1484
14:00 12/24	16:00-18:00	601

TABLE XIX. Dark bottle counts per minute per hour of incubation. December 21-24, 1962. NB71: 5.

Incubation period	Counts per minute per hour of incubation	
	Sample times immediately prior to incubation.	Sample times as shown in Table XVIII. (@13:00-14:00)
06:00-08:00	17	29
08:00-10:00	15	29
10:00-12:00	18	22
12:00-14:00	24	31
14:00-16:00	20	48
16:00-18:00	32	32
18:00-20:00	26	49
20:00-22:00	32	36
22:00-24:00	29	42
24:00-02:00	25	47
02:00-04:00	31	60
04:00-06:00	21	52
06:00-08:00	14	53
08:00-10:00	19	75
10:00-12:00	19	57
12:00-14:00	17	44
14:00-16:00	21	39
16:00-18:00	17	35
18:00-20:00	20	41
20:00-22:00	37	42
22:00-24:00	27	32
24:00-02:00	25	57
02:00-04:00	29	46
04:00-06:00	34	37
06:00-08:00	19	31
08:00-10:00	25	34
10:00-12:00	34	41
12:00-14:00	27	36
14:00-16:00	26	48
16:00-18:00	34	56

TABLE XX. Dry weight and pigments per cubic meter.
December 22-24, 1962. NB71: 4, 14.

Sample time & date		Grams dry weight per m^3	mgs Chlorophyll per m^3				mgs Carotinoids per m^3	
			a	b	c	Total	Non Astacine	Astacine
06:00	12/22	5.763	00.38	00.20	00.61	01.19	0.06	0.10
08:00		7.896	00.56	00.24	00.57	01.37	0.02	0.10
10:00		6.489	00.53	00.16	00.49	01.17	0.03	0.08
12:00		6.819	00.39	00.12	00.34	00.85	0.06	0.06
14:00		6.156	00.39	00.13	00.24	00.77	0.04	0.06
16:00		6.076	00.52	00.22	00.42	01.16	0.05	0.07
18:00		6.526	00.49	00.19	00.27	00.95	0.09	0.05
20:00		6.886	00.49	00.17	00.52	01.18	0.06	0.08
22:00		6.609	00.39	00.13	00.33	00.85	0.05	0.06
24:00		7.023	00.38	00.13	00.31	00.81	0.05	0.06
02:00	12/23	7.546	00.36	00.14	00.27	00.77	0.04	0.07
04:00		7.009	00.45	00.18	00.55	01.18	0.05	0.11
06:00		7.013	00.39	00.13	00.24	00.77	0.09	0.05
08:00		8.616	00.59	00.23	00.54	01.37	0.08	0.07
10:00		6.589	00.33	00.08	00.06	00.36	0.07	0.03
12:00		5.916	00.32	00.09	00.37	00.78	0.04	0.07
14:00		5.459	00.29	00.07	00.17	00.54	0.09	0.03
16:00		5.859	00.53	00.16	00.44	01.13	0.13	0.04
18:00		5.696	00.46	00.14	00.37	00.97	0.12	0.06
20:00		6.146	00.37	00.14	00.26	00.77	0.15	0.04
22:00		6.486	00.39	00.12	00.34	00.85	0.09	0.05
24:00		5.756	00.39	00.12	00.34	00.85	0.12	0.04
02:00	12/24	7.436	00.60	00.17	00.61	01.38	0.13	0.12
04:00		5.976	00.40	00.10	00.48	00.99	0.15	0.08
06:00		5.673	00.49	00.17	00.52	01.18	0.13	0.08
08:00		5.193	00.46	00.12	00.61	01.19	0.06	0.07
10:00		5.206	00.38	00.18	00.85	01.41	0.04	0.11
12:00		6.623	00.56	00.21	00.39	01.16	0.14	0.06
14:00		7.563	00.95	00.41	00.57	01.94	0.16	0.11
16:00		7.503	00.73	00.40	00.40	01.53	0.03	0.14

EXPERIMENT 10

(Notebook 71: 38-97. November 20-24, 1963.)

Procedure: As for Experiment 1, with the following modifications.

a. Inoculations were made with stock no. 9 carbon-14 (activity, 7.26×10^6 counts/min.).

b. Samples taken every two hours and incubated for two hours in both the unpainted galvanized sunlight incubators (A_1) and the 1958-type fluorescent light incubators (A_2). Table XXI.

c. Samples taken every two hours and incubated for 24 hours in both the unpainted galvanized sunlight (B_1) and the 1958-type fluorescent light incubators (B_2). Table XXII.

d. Samples taken every two hours and held under natural sunlight conditions in unpainted galvanized sunlight incubators until the first following 14:00, at which time they were inoculated and immediately incubated for two hours in the 1958-type fluorescent light incubator (C). Table XXIII.

e. Samples (approximately 150 liters) taken at about 13:00-14:00 and held under natural sunlight conditions in 2' x 2' x 5' white fiberglass tub. Aliquots were withdrawn from this tub every two hours, inoculated, and immediately incubated for two hours in the 1958-type fluorescent light incubators (D). Table XXIV.

f. Dark bottles, with water sources similar to A and D treatments and with incubation periods concurrent to these respectively, were held in a bucket of water in the laboratory. Table XXV.

TABLE XXI. Mean of two light bottles in counts per minute per hour of incubation. November 21-24, 1963. NB71: 44-87.

Incubation period & date		Counts per minute per hour of incubation: Sunlight incubator (A_1)	Fluorescent incubator (A_2)
06:00-08:00	11/21	100	161
08:00-10:00		194	253
10:00-12:00		425	695
12:00-14:00		522	795
14:00-16:00		443	699
16:00-18:00		563	1010
18:00-20:00		21	261
20:00-22:00		15	150
22:00-24:00		16	126
24:00-02:00	11/22	20	157
02:00-04:00		16	210
04:00-06:00		18	269
06:00-08:00		128	201
08:00-10:00		251	526
10:00-12:00		439	1003
12:00-14:00		277	1127
14:00-16:00		1089	1272
16:00-18:00		1003	1620
18:00-20:00		20	725
20:00-22:00		28	429
22:00-24:00		30	259
24:00-02:00	11/23	28	313
02:00-04:00		31	270
04:00-06:00		29	362
06:00-08:00		198	364
08:00-10:00		328	735
10:00-12:00		446	1042
12:00-14:00		550	1563
14:00-16:00		778	1720
16:00-18:00		1233	1878
18:00-20:00		34	712
20:00-22:00		31	300
22:00-24:00		34	293
24:00-02:00	11/24	27	234
02:00-04:00		24	250
04:00-06:00		51	263
06:00-08:00		284	483
08:00-10:00		671	808
10:00-12:00		143	927
12:00-14:00		547	1968
14:00-16:00		1408	2656
16:00-18:00		1644	2739

TABLE XXII. Mean of two light bottles in counts per minute per hour of incubation. November 21-24, 1963. NB71: 44-87.

Incubation period	Counts per minute per hour of incubation	
	Sunlight incubator (B_1)	Fluorescent incubator (B_2)
06:00-06:00	102	121
08:00-08:00	92	166
10:00-10:00	347	358
12:00-12:00	397	488
14:00-14:00	322	387
16:00-16:00	382	156
18:00-18:00	247	93
20:00-20:00	239	101
22:00-22:00	140	50
24:00-24:00	199	53
02:00-02:00	174	407
04:00-04:00	186	382
06:00-06:00	150	165
08:00-08:00	202	489
10:00-10:00	396	900
12:00-12:00	588	943
14:00-14:00	590	923
16:00-16:00	609	1003
18:00-18:00	445	1035
20:00-20:00	298	558
22:00-22:00	233	394
24:00-24:00	290	435
02:00-02:00	218	396
04:00-04:00	208	317
06:00-06:00	202	357
08:00-08:00	165	279
10:00-10:00	285	603
12:00-12:00	537	746
14:00-14:00	567	652
16:00-16:00	551	737
18:00-18:00	490	588

TABLE XXIII. Mean of two light bottles in counts per minute per hour of incubation. Fluorescent incubator. November 21-24, 1963. NB71: 44-87.

Sample time and date		Incubation period		Counts per minute per hour of incubation (C)
06:00	11/21	14:00-16:00	11/21	270
08:00		"		407
10:00		"		731
12:00		"		727
14:00		"		1103
16:00		14:00-16:00	11/22	1278
18:00		"		1227
20:00		"		384
22:00		"		495
24:00		"		444
02:00	11/22	"		641
04:00		"		618
06:00		"		446
08:00		"		406
10:00		"		643
12:00		"		736
14:00		"		1591
16:00		14:00-16:00	11/23	1766
18:00		"		1386
20:00		"		689
22:00		"		849
24:00		"		1053
02:00	11/23	"		1108
04:00		"		840
06:00		"		881
08:00		"		1003
10:00		"		960
12:00		"		1205
14:00		"		1515
16:00		14:00-16:00	11/24	2198
18:00		"		1829
20:00		"		993
22:00		"		910
24:00		"		844
02:00	11/24	"		813
04:00		"		900
06:00		"		940
08:00		"		1153
10:00		"		984
12:00		"		1008

TABLE XXIV. Mean of two light bottles in counts per minute per hour of incubation. Fluorescent incubator. November 20-24, 1963. NB71: 44-87.

Sample time and date	Incubation period	Counts per minute per hour of incubation (D)
14:00 11/20	06:00-08:00 11/21	277
"	08:00-10:00	287
"	10:00-12:00	353
"	12:00-14:00	375
"	14:00-16:00	315
13:00-13:45 11/21	16:00-18:00	477
"	18:00-20:00	453
"	20:00-22:00	328
"	22:00-24:00	277
"	24:00-02:00 11/22	296
"	02:00-04:00	307
"	04:00-06:00	375
"	06:00-08:00	304
"	08:00-10:00	602
"	10:00-12:00	750
"	12:00-14:00	767
"	14:00-16:00	536
13:00-13:15 11/22	16:00-18:00	1371
"	18:00-20:00	1413
"	20:00-22:00	460
"	22:00-24:00	502
"	24:00-02:00 11/23	493
"	02:00-04:00	579
"	04:00-06:00	672
"	06:00-08:00	1009
"	08:00-10:00	1522
"	10:00-12:00	1918
"	12:00-14:00	2594
"	14:00-16:00	1868
13:30-13:45 11/23	16:00-18:00	1634
"	18:00-20:00	1176
"	20:00-22:00	720
"	22:00-24:00	727
"	24:00-02:00 11/24	609
"	02:00-04:00	702
"	04:00-06:00	808
"	06:00-08:00	984
"	08:00-10:00	1461
"	10:00-12:00	1759
"	12:00-14:00	1080
"	14:00-16:00	1649
14:00 11/24	16:00-18:00	2533

TABLE XXV. Dark bottle counts per minute per hour of incubation. November 21-24, 1963. NB71: 44-87.

Incubation period & date		Counts per minute per hour of incubation: Sample times immediately prior to incubation (A)	Counts per minute per hour of incubation: Sample times as shown in Table XXIV. (D)
06:00-08:00	11/21	25	--
08:00-10:00		23	--
10:00-12:00		25	--
12:00-14:00		20	--
14:00-16:00		19	24
16:00-18:00		25	25
18:00-20:00		17	33
20:00-22:00		19	57
22:00-24:00		19	96
24:00-02:00		20	121
02:00-04:00	11/22	17	102
04:00-06:00		20	99
06:00-08:00		16	76
08:00-10:00		22	102
10:00-12:00		54	75
12:00-14:00		29	83
14:00-16:00		19	75
16:00-18:00		40	56
18:00-20:00		38	45
20:00-22:00		26	50
22:00-24:00		24	55
24:00-02:00		33	75
02:00-04:00	11/23	34	57
04:00-06:00		33	56
06:00-08:00		28	45
08:00-10:00		65	64
10:00-12:00		34	207
12:00-14:00		117	208
14:00-16:00		56	136
16:00-18:00		87	54
18:00-20:00		145	34
20:00-22:00		128	86
22:00-24:00		53	117
24:00-02:00		47	195
02:00-04:00	11/24	24	268
04:00-06:00		27	313
06:00-08:00		47	319
08:00-10:00		41	274
10:00-12:00		44	352
12:00-14:00		60	362
14:00-16:00		38	175
16:00-18:00		51	28

EXPERIMENT 11
(Notebook 63: 18-20. June 14, 1962.)

Procedure: As for Experiment I, but with aliquot samples incubated in three different incubators.

1. Unpainted galvanized iron sunlight incubator.

2. 1961-type fluorescent light incubator with single ballast.

3. 1961-type fluorescent light incubator with double ballast.

Three sets of bottles, each consisting of two light and one dark bottle, were used for each type of incubation technique.

TABLE XXVI. Six light bottles and, in parentheses, three dark bottles in counts per minute per hour of incubation. June 14, 1962. NB63: 19-20.

Incubation period	Counts per minute per hour of incubation		
	Sunlight incubator	Fluorescent, single ballast incubator	Fluorescent, double ballast incubator
11:55-15:00	1234	1564	2491
	1428	1396	2512
	1518	1154	2940
	1549 (28)	1554 (23)	2892 (38)
	1292 (36)	1424 (21)	2619 (32)
	1247 (31)	1335 (34)	2590 (27)
Mean	1378 (32)	1405 (26)	2674 (32)

EXPERIMENT 12

(Notebook 63: 21-24. June 22, 1962.)

Procedure: As for Experiment 1, but with aliquot samples incubated in three different incubators and, in each, with neutral density filters which permitted light penetration at approximately 64%, 30%, 16% and 1% as well as incubation at full light intensity.

1. Unpainted galvanized iron sunlight incubator.
2. 1961-type fluorescent incubator with single ballast.
3. 1961-type fluorescent incubator with double ballast.

TABLE XXVII. Mean of two light bottles in counts per minute per hour of incubation. June 22, 1962. NB63: 22-23.

Incubation period	Neutral density filter	Counts per minute per hour of incubation		
		Sunlight incubator	Fluorescent, single ballast incubator	Fluorescent, double ballast incubator
10:10-13:10	None	581	521	568
	64%	1034	395	421
	30%	731	100	143
	16%	321	45	55
	1%	100	18	24

EXPERIMENT 13
(Notebook 63: 32-34. July 6, 1962.)

Procedure: As for Experiment 1, but with aliquot samples incubated in three different incubators and, in each, with neutral density filters which permitted light penetration of approximately 64%, 30%, 16%, and 1% as well as incubation at full light intensity.

1. Unpainted galvanized iron sunlight incubator.
2. 1961-type fluorescent light incubator with single ballast.
3. 1958-type fluorescent light incubator.

Six dark bottles were held in a bucket of running water in the laboratory.

TABLE XXVIII. Mean of two light and six dark bottles in counts per minute per hour of incubation. July 6, 1962. NB63: 33-34.

Incubation period	Counts per minute per hour of incubation				
	Neutral density filter	Sunlight incubator	1961-type fluorescent, single ballast incubator	1958-type fluorescent incubator	Mean of dark bottles
09:50 to	None	661	724	1155	17
13:00-13:58	64%	964	449	845	
	30%	852	172	271	
	16%	525	47	136	
	1%	110	14	28	

EXPERIMENT 14

(Notebook 68: 28-33. July 21, 1962.)

Procedure: As for Experiment 1, but with aliquot samples incubated in three different incubators and, in each, with neutral density filters which permitted light penetration of approximately 64% and 16% as well as incubation at full light intensity.

1. Black painted galvanized iron sunlight incubator.
2. White painted galvanized iron sunlight incubator.
3. Unpainted galvanized iron sunlight incubator.

Dark bottles were in the incubators themselves. The water sample was taken in the natatorium at 11:45 although the incubations were from @ 12:09 to 18:15-18:48.

TABLE XXIX. Mean of two light bottles and dark bottles, in parentheses, in counts per minute per hour of incubation. July 21, 1962. NB68: 28-33.

Incubation period	Neutral density filter	Counts per minute per hour of incubation		
		Black sunlight incubator	White sunlight incubator	Unpainted sunlight incubator
12:09 to	None	540 (14)	696 (15)	547 (13)
18:15-18:48	64%	332	472	567
	16%	36	57	236

EXPERIMENT 15
(Notebook 68: 43-47. July 25, 1962.)

Procedure: As for Experiment 1, but with aliquot samples incubated in five different incubators and, in each, with neutral density filters which permitted light penetration of approximately 64%, 30%, 16% and 1% as well as incubation at full light intensity.

1. Black painted galvanized iron sunlight incubator.
2. White painted galvanized iron sunlight incubator.
3. Black bottom 1961-type fluorescent light incubator with single ballast.
4. White bottom 1961-type fluorescent light incubator with single ballast.
5. 1958-type fluorescent light incubator.

Five dark bottles were held in a bucket of water in the laboratory. The water sample was taken in the natatorium at 11:50 although the incubations were from @ 13:00 to 17:40-19:16.

TABLE XXX. Mean of two light and five dark bottles in counts per minute per hour of incubation. July 25, 1962. NB68: 42-47.

Incubation period	Neutral density filters	Counts per minute per hour of incubation					
		Black sunlight incubator	White sunlight incubator	Black 1961-type fluorescent incubator	White 1961-type fluorescent incubator	1958-type fluorescent incubator	Mean of dark bottles
@13:00 to	none	837	951	887	1319	1683	19
17:40-19:16	64%	1154	1352	904	1037	1210	
	30%	998	886	197	302	732	
	16%	400	486	78	100	170	
	1%	120	115	24	22	37	

EXPERIMENT 16

(Notebook 63: 90-97. October 6, 1962.)

Procedure: As for Experiment 1, but with aliquot samples incubated in four different incubators and, in each, with neutral density filters which permitted light penetration of approximately 64%, 30% and 1% as well as incubation at full light intensity.

1. Black painted galvanized iron sunlight incubator.
2. White painted galvanized iron sunlight incubator.
3. 1958-type fluorescent light incubator.
4. 1958-type fluorescent light incubator lined with aluminum foil.

Three dark bottles were held in a bucket of water in the laboratory. The water sample was taken at the natatorium at 09:55 although the incubations were from 10:30 to 13:23-14:00.

TABLE XXXI. Mean of two light and three dark bottles in counts per minute per hour of incubation. October 6, 1962. NB63: 94-97.

Incubation period	Neutral density filter	Counts per minute per hour of incubation				
		Black sunlight incubator	White sunlight incubator	1958-type fluorescent incubator	1958-type fluorescent incubator (w/ aluminum)	Mean of dark bottles
10:30 to	None	452	327	794	889	14
13:23-14:00	64%	634	634	506	623	
	30%	487	690	244	569	
	1%	59	122	26	443	

EXPERIMENT 17

(Notebook 63: 44-51. August 14, 1962.)

Procedure: As for Experiment 1 but with modifications in the acid washing technique.

Experimental treatments were as follows:

1. HCl fumes, planchets exposed to fumes for 10 min.
2. HCl fumes, planchets exposed to fumes for 1 min.
3. No acid with 35 g/l NaCl.
4. 0.001 N HCl in 35 o/oo NaCl.
5. 0.00 N HCl in 35 o/oo NaCl.
6. 0.1 N HCl in 35 o/oo NaCl.
7. 1 N HCl in 35 o/oo NaCl.
8. 10 N HCl in 35 o/oo NaCl.

Light bottles were incubated in an unpainted galvanized iron sunlight incubator and dark bottles were held in a 1958-type fluorescent light incubator with circulating water but the lights turned off.

Incubation ceased when the individual bottles were filtered. After filtering each set (3 light and 3 dark bottles), the sets were treated accordingly. In the case of the liquid solutions, 10 ml of solution was used on each planchet just before the final rinse with 25 ml of clean filtered sea water. In the case of the HCl fumes, the manifold filter apparatus was inverted over bottles containing concentrated HCl with the vacuum pump still running. After exposing planchets to fumes for the required time, the planchets were rinsed with 25 ml of clean filtered sea water.

TABLE XXXII. Light and dark bottle counts per minute per hour of incubation resulting from experiments when different methods of planchet preparation were followed in regard to the removal of inorganic carbon from the phytoplankton populations caught on membrane filters. August 14, 1962. NB63: 46-51.

		No acid	HCl in 35 o/oo NaCl					HCl fumes	
		35 g/1 NaCl	0.001 N HCl	0.01 N HCl	0.1 N HCl	1 N HCl	10 N HCl	1 min.	10 mins
Light bottles	a	879	924	1076	890	1020	591	1415	1489
	b	845	1045	1030	891	907	703	1261	1332
	c	729	1096	1103	932	1135	586	1389	1618
	Mean	818	1022	1070	904	1021	627	1355	1480
Dark bottles	a	11	7	8	7	9	7	11	13
	b	12	9	7	9	8	8	10	12
	c	11	9	9	8	8	5	11	8
	Mean	11	8	8	8	8	7	11	11

EXPERIMENT 18

(Notebook 63: 54-59. August 30, 1962.)

Procedure: As for Experiment 17 but with the following treatments and modifications.

1. HCl fumes, planchets exposed to fumes for 30 secs.
2. HCl fumes, planchets exposed to fumes for 1 min.
3. No acid with 35 g/l NaCl.
4. 0.001 N HCl in 35 g/l NaCl.
5. 0.01 N HCl in 35 g/l NaCl.
6. 0.1 N HCl in 35 g/l NaCl.
7. 1.0 N HCl in 35 g/l NaCl.
8. 10 N HCl in 35 g/l NaCl.

In the laboratory the 5-gallon carboy was shaken vigorously for 1 minute and then it was inoculated with six large ampoules, each containing 10 ml. The carboy was again shaken for 2 minutes after which half of the sea water was transferred to another carboy. One of the carboys was completely covered with aluminum foil and placed on the water table with water continuously running over the entire surface of the carboy. The other was placed on the roof with water also continuously running over the entire surface. Both carboys were shaken every 15 minutes.

Immediately following a 3-hr. and 15 minute incubation period, the carboy on the roof was taken into the laboratory and covered with aluminum foil.

Water from this carboy was then poured into 3 light bottles, and 3 dark bottles were filled from the carboy which had been covered with aluminum foil in the laboratory. These bottles were then filtered while another 6 bottles were being filled. After the first 6 bottles were filtered, these same bottles were rinsed with filtered sea water and filled up again. Therefore, throughout the experiment, only 12 bottles were used (6 light bottles and 6 dark bottles).

TABLE XXXIII. Light and dark bottle counts per minute per hour of incubation resulting from experiments when different methods of planchet preparation were followed in regard to the removal of inorganic carbon from the phytoplankton populations caught on membrane filters.
August 30, 1962. NB63: 56-59.

	No acid	HCl in 35 o/oo NaCl					HCl fumes	
	35 o/oo NaCl	0.001 N HCl	0.01 N HCl	0.1 N HCl	1.0 N HCl	10.0 N HCl	1/2 min.	1 min.
Light bottles a	364	378	406	440	466	302	510	496
Light bottles b	329	397	428	428	421	290	510	483
Light bottles c	362	370	395	422	434	258	495	551
Mean	352	382	410	430	440	283	505	510
Dark bottles a	13	12	10	13	11	7	20*	13
Dark bottles b	12	12	11	13	10	9	13	13
Dark bottles c	14	11	10	14	10	8	13	11
Mean	13	12	10	13	10	8	15	12

* Brown particles on planchet.

EXPERIMENT 19

(Notebook 63: 62-67. September 10, 1962.)

Procedure: As for Experiment 17 but with the following treatments.

1. No acid with 35 o/oo NaCl.
2. 0.001 N HCl with 35 o/oo NaCl.
3. 0.01 N HCl with 35 o/oo NaCl.
4. 0.1 N HCl with 35 o/oo NaCl.
5. 1.0 N HCl with 35 o/oo NaCl.
6. 3.0 N HCl with 35 o/oo NaCl.
7. 6.0 N HCl with 35 o/oo NaCl.
8. 10.0 N HCl with 35 o/oo NaCl.

The incubation period was for approximately 3 hours.

TABLE XXXIV. Light and dark bottle counts per minute per hour of incubation resulting from experiments when different methods of planchet preparation were followed in regard to the removal of inorganic carbon from the phytoplankton populations caught on membrane filters. September 10, 1962. NB63: 64-67.

		35 o/oo NaCl	HCl in 35 o/oo NaCl						
		No acid	0.001 N HCl	0.01 N HCl	0.1 N HCl	1.0 N HCl	3.0 N HCl	6.0 N HCl	10.0 N HCl
Light bottles	a	281	328	290	285	276	277	265	179
	b	308	307	305	275	265	293	270	184
	c	290	316	304	301	294	279	244	195
	Mean	293	317	300	287	278	283	259	186
Dark bottles	a	15	15	13	13	12	11	12	9
	b	15	16	13	12	14	13	13	9
	c	15	15	12	13	13	14	11	8
	Mean	15	15	13	13	13	13	12	9

EXPERIMENT 20

(Notebook 72: 82-87. May 19, 1962.)

Procedure: As for Experiment 1 except that replicate samples were incubated with and without mylar film filters at @ 100%, 64%, 30%, 16% and 1% of incident sunlight intensity.

TABLE XXXV. Light bottle counts per minute per hour of incubation. Unpainted galvanized iron sunlight incubation. May 19, 1962. NB72: 83.

Incubation period	Neutral density filter	Counts per minute per hour of incubation	
		Without mylar	With mylar
12:20-15:30	none	3895	6909
	64%	6925	6607
	30%	5534	5723
	16%	3265	2501
	1%	432	227

1. Productivity index, photosynthetic biomass, bottle effects and standard sampling time

Productivity data from experiments performed at Naples (NB31: 74-75) with inshore phytoplankton samples have been in direct contrast with results from open ocean cruises. The disagreement referred to here is in respect to the relative carbon-14 uptake during morning (06:00-12:00) incubation and afternoon (12:00-18:00) incubation with samples taken at 06:00 and 12:00, respectively. Inshore waters have had higher afternoon productivity and ocean waters a higher morning productivity. This interesting phenomenon is possibly a reflection of either the periodicity (Doty & Oguri, 1957; Doty, 1959) displayed by various photosynthetic organisms or biotic variations between sampling times and seems to indicate that the productive cycles for open and inshore phytoplankton populations are different.

Ryther, et al. (1958), as well as others, have also found that daily productivity measurements varied depending upon the time of the day when such measurements were initiated and terminated.

In light of these findings and the fact that current workers are not all in agreement on standardized sample times and incubation periods, a series of experiments has been performed to give us more definitive information bearing on carbon-14 fixation as a function of these variables. Secondly, it was anticipated that regression factors could be determined which would relate mean 24 hour productivity to productivity determined for any particular segment of a 24 hour period.

Experiment 1, June 27-28, 1962, our initial controlled effort in this direction, supports the Naples data in that the afternoon fixation in light bottles was several times greater than that of the early morning. The disparity of results from the five incubation periods was evidence that further work in this direction was needed. The difference in productivity between 24-hour incubations started at 06:00 and 12:00 was of particular concern and will be elaborated upon later.

Experiments 2, 3, 4, 5 and 6 were modeled after Experiment 1 with the addition of several more incubator types. Among the several purposes for which these were designed were those of verifying the conclusion from Experiment 1 and determining the constancy of the productivity results for the five different incubation periods. Table XXXVI shows the light bottle fixation of each period, relative to the 12:00-18:00 results taken as 100% for these six experiments.

Daily variations in productivity, relative to the standard period of 12:00-18:00 used here, are greater than between incubators of different types for the same period. Although these data do not permit the selection of a standard time or lend themselves to a determination of productivity for a 24 hour period (i.e., they do not provide a basis for making a selection), they led to the more detailed work of Experiments 7-10.

The results of Experiment 7, in which samples were taken for 31 consecutive hours and incubated in a constant light source as well as natural sunlight, illustrate the periodic fluctuation by time for organic carbon formation. As will be more thoroughly discussed later, fixation was greater in fluorescent light than in natural sunlight.

At the time of this experiment, we were ascribing these hourly variations to changes in the "productivity index", the fixation potential

TABLE XXXVI. Relative light bottle fixation for different incubation periods when 12:00-18:00 results are taken as 100%. All incubations started on the date shown at the top of each column.

a. Unpainted galvanized iron sunlight incubator. June 27-28, 1962. NB63: 28.

Incubation period	June 27th
06:00-12:00	35
06:00-18:00	57
06:00-06:00	28
12:00-18:00	100
12:00-12:00	50

b. Unpainted galvanized iron sunlight incubator. July 14-31, 1962. NB68: 74-75.

Incubation period	Incubations started on July:																		
	14th	15th	16th	17th	18th	19th	20th	21st	22nd	23rd	24th	25th	26th	27th	28th	29th	30th	31st	Mean
06:00-12:00	45	40	50	31	35	48	45	25	29	33	49	21	23	32	47	26	30	31	36
06:00-18:00	66	62	95	61	47	78	62	64	60	57	77	50	33	67	69	34	54	43	60
06:00-06:00	30	25	31	11	19	29	32	27	27	24	31	23	16	22	24	16	27	24	24
12:00-18:00	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
12:00-12:00	59	54	81	34	43	77	61	52	66	43	55	46	48	46	42	51	67	58	55

c. Black painted galvanized iron sunlight incubator. July 20-31, 1962. NB68: 74-75.

Incubation period	Incubations started on July:												
	20th	21st	22nd	23rd	24th	25th	26th	27th	28th	29th	30th	31st	Mean
06:00-12:00	35	30	28	36	33	33	30	43	56	39	35	29	36
06:00-18:00	58	51	31	55	47	53	35	70	64	55	64	44	52
06:00-06:00	23	28	17	23	22	26	17	24	35	22	27	24	24
12:00-18:00	100	100	100	100	100	100	100	100	100	100	100	100	100
12:00-12:00	62	72	52	38	28	47	47	52	57	52	56	43	51

d. Black painted galvanized iron sunlight incubator. August 15-22, 1962. NB70: 37-39.

Incubation period	Incubations started on August:							
	15th	16th	17th	18th	19th	20th	21st	Mean
06:00-12:00	21	22	14	36	23	16	29	23
06:00-18:00	--	--	--	--	--	--	--	--
06:00-06:00	17	14	9	17	12	17	22	15
12:00-18:00	100	100	100	100	100	100	100	100
12:00-12:00	54	45	36	41	69	53	78	54

e. 1958-type fluorescent light incubator. August 17-22, 1962. NB70: 37-39.

Incubation period	Incubations started on August:					
	17th	18th	19th	20th	21st	Mean
06:00-12:00	9	24	27	22	22	21
06:00-18:00	--	--	--	--	- --	--
06:00-06:00	6	22	17	14	19	16
12:00-18:00	100	100	100	100	100	100
12:00-12:00	29	41	50	60	54	47

f. Black painted galvanized iron sunlight incubator. September 12-13 1962. NB63: 98.

Incubation period	September 12th
06:00-12:00	18
06:00-18:00	27
06:00-06:00	10
12:00-18:00	100
12:00-12:00	46

g. 1958-type fluorescent light incubator. September 12-13, 1962. NB63: 98.

Incubation period	September 12th
06:00-12:00	14
06:00-18:00	27
06:00-06:00	8
12:00-18:00	100
12:00-12:00	36

per unit of chlorophyll, although there were indications from 24-hour incubations of the earlier experiments (#1-6) that some other factor(s) was, at least in part, responsible for the changes in absolute carbon uptake as measured. Yentsch & Ryther (1957), Yentsch & Scagel (1958), Shimada (1958), Ichimura (1960) and others have produced evidence that there are diurnal rhythms in amount of chlorophyll of surface waters.

Experiment 8 was designed to explore the apparent fixation periodicity evident with samples incubated for 24 hours and, further, to compare fixation during this incubation period with that from 2-hour incubations.

Figure 1 illustrates the periodicity of organic carbon formation for samples taken every 2 hours and incubated for 2 hours and 24 hours in both fluorescent light and natural sunlight incubators.

Note that the noon depression in fixation as measured by the 2-hour incubation periods also shows up with the 24-hour incubations. A logical explanation for this and other similarities is that the plankton of the sampled surface water differ in either or both quantity and quality for different times of day. Otherwise, one would expect fairly uniform fixation for all 24-hour incubations, just as it is logical to suppose that natatorium water, _in situ_, has equal potential for productivity over any given 24 hour period. If periodicity in fixation potential, per unit of chlorophyll, can be discounted as an explanation for the variation between samples incubated for 24 hours, this variation could be due to sample variations in biomass. The results of 2-hour incubations, however, are a function of both potential fixation per unit of chlorophyll and photobiomass (or chlorophyll) _per se_. It would

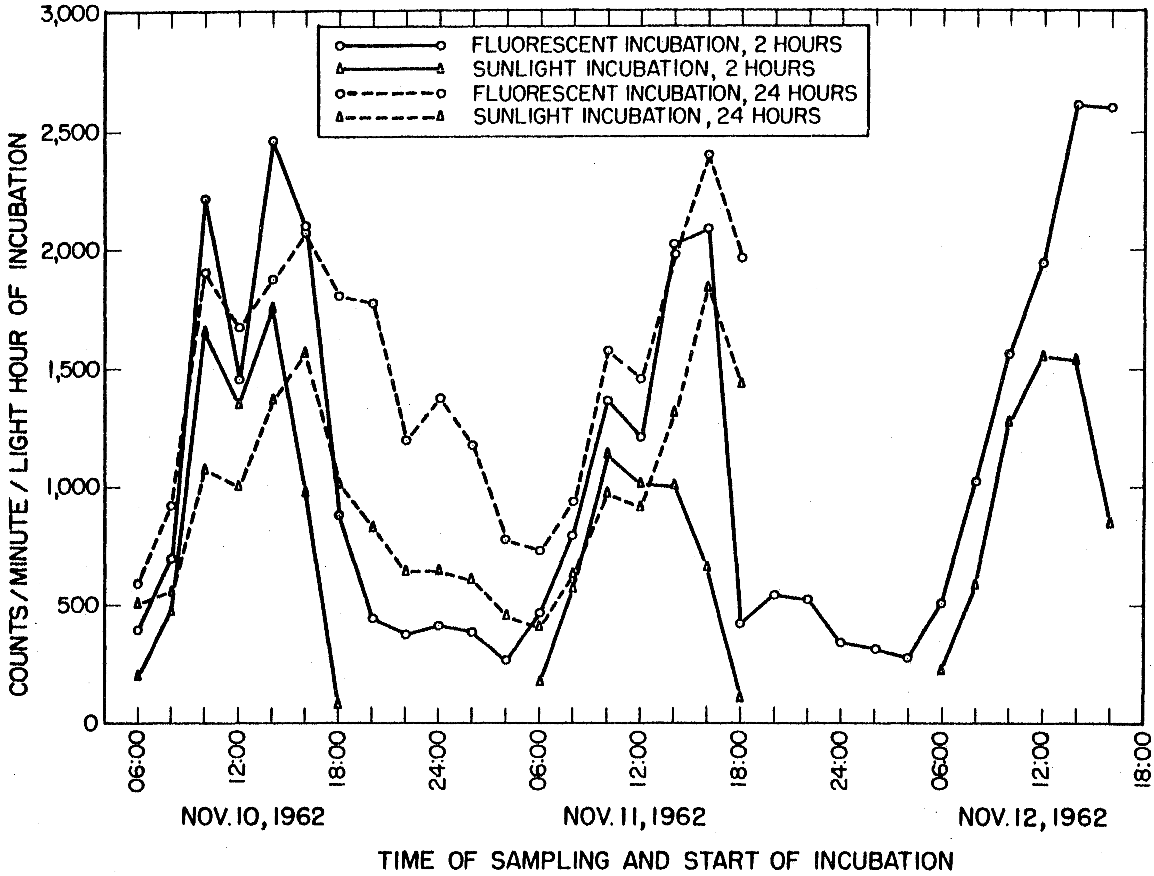

Figure 1. Carbon fixation rate as a function of sample time in hours, for different incubation periods and types of incubators. NB70: 65. Experiment 8.

follow that the empirical difference in carbon-14 uptake for the two incubation periods is a measure of the actual periodicity in the "productivity index". Treating the counts per minute per light hour of incubation in this way gives results as shown in Figure 2. It seems that the photosynthetic biomass, or chlorophyll content thereof, is at a minimum at 06:00 and maximum at 16:00 as shown by 24-hour incubations. In contrast to this, the fixation potential of a given biomass ranges from a low @ 18:00-20:00 to a high at 14:00.

Yentsch & Ryther (1957) and Shimada (1958) have found chlorophyll a, as mg/m^3, to increase during the dark and decrease during the light period of the day. In both these papers, the chlorophyll a data have been plotted together with carbon fixation and simultaneous fluctuations of both appear to be well correlated.

The results from these two investigations are shown clearly enough in their respective Figures 1, that it has been possible to extract the data for both chlorophyll a and carbon-14 uptake. This has been done with results as shown below and, in addition, a "productivity index" as calculated from their data has been added.

Yentsch & Ryther (1957)

Time		Mg chl. a/m^3	Counts/min-10^3	PI
12:00	7/18/56	0.97	5.7	4.8
16:00		0.74	4.6	6.2
20:00		1.10	5.5	5.0
24:00		1.10	3.8	3.5
04:00	7/19	1.64	4.3	2.6
08:00		2.00	8.6	4.3
12:00		1.64	6.1	3.7

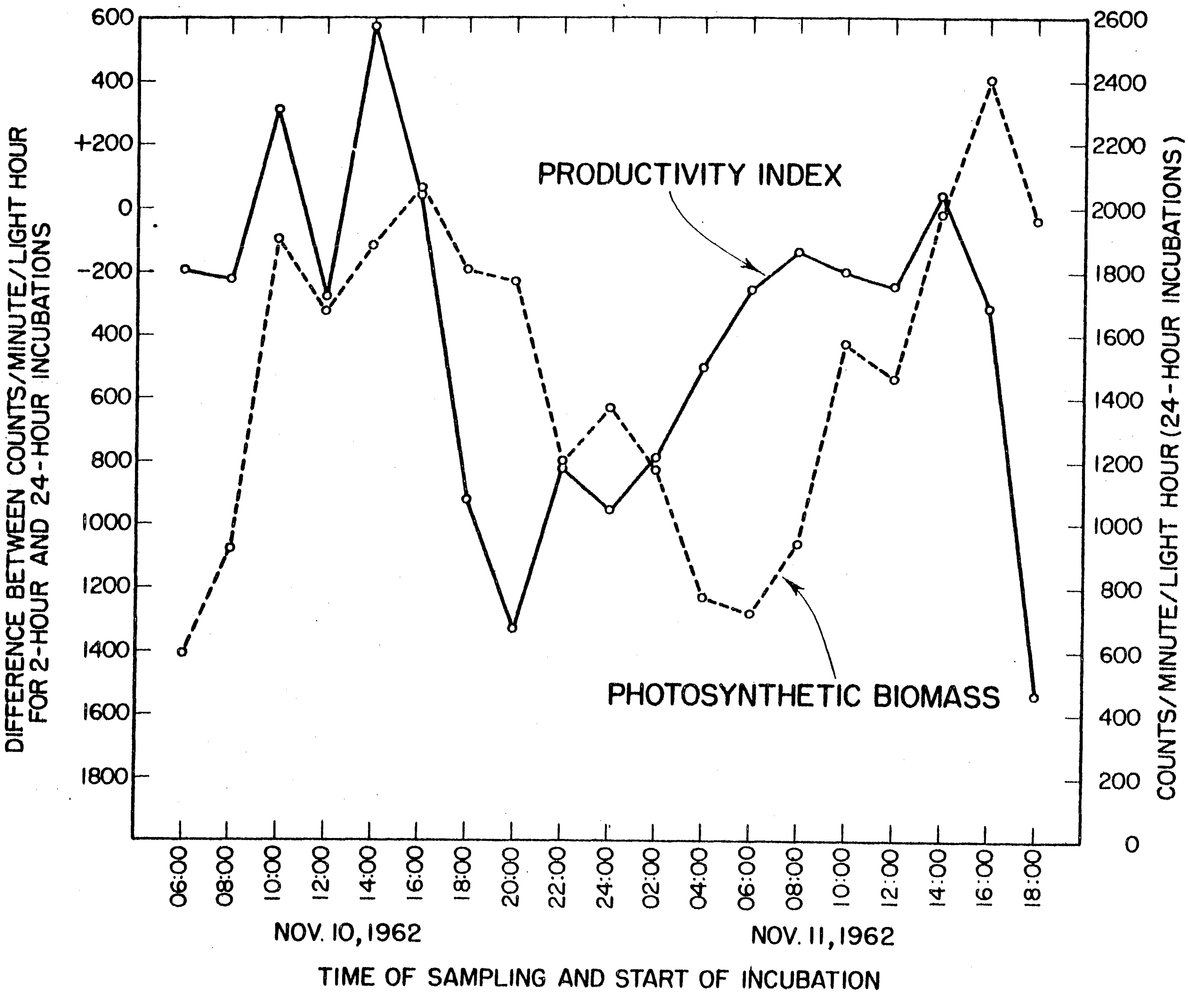

Figure 2. Periodicity of productivity index, as the difference between 2- and 24-hour incubations, and photosynthetic biomass, as a result of 24-hour incubations as a function of sample time in hours. NB70: 69. Experiment 8.

Shimada (1958)

Time		Mg chl. a/m^3	Mg C/m^3/hr.	PI
18:00	5/28/57	0.114	0.21	5.4
22:00		0.123	0.19	6.5
02:00	5/29	0.130	0.34	3.8
06:00		0.149	0.63	2.4
10:00		0.117	0.50	2.3
14:00		0.094	0.34	2.8
18:00		0.080	0.14	5.7
22:00		0.088	0.27	3.3
02:00	5/30	0.110	0.35	3.1
06:00		0.128	0.41	3.1
10:00		0.131	0.36	3.6
14:00		0.103	0.27	3.8

In both these studies, it can be seen that the range in chlorophyll a over a 24 hour period is actually less than is the range in carbon-14 uptake per mg of chlorophyll. The productivity index cycles do not correspond with what we show in Figure 6 with regard to the time when minimum occurs, but Yentsch & Ryther's 16:00 peak is near to that which we find at 14:00.

One approach toward verification of these time periods as extremes of fixation potential would be to run subsamples from a single large sample, taken at one time of day, over a 24 hour period. An approximation of such an experiment was performed during Smith cruise #33, using 2-hour incubations only. This work (NB21) is reported in Annual Report, 1956, p. 30 and Fig. 9. The data from this cruise have been translated into light bottle counts per minute per hour of incubation with the results shown in Figure 3. Note that in both this and Figure 2, the least potential is expressed at 18:00-20:00 and the greatest at 10:00-14:00. Also, this potential builds up slowly during the night and early morning hours, dropping rapidly in the afternoon.

Experiment 8 also provided evidence which indicates that the so-called "bottle effect" does not seem to have particularly influenced fixation values received with 24-hour incubation periods.

Our approach has been as follows: average "standardized" counts per minute per hour for a 24 hour period have been calculated for 12 successive 2-hour incubation periods of samples taken every 2 hours. It is possible, thus, to compare these results with those for 12 successive samples taken every 2 hours, each held for 24 hours. Only sunlight hours, accepted as being from 06:00-18:00, are used for this purpose. Table XXXVII shows total counts for a 12 hour light period and a 12 hour dark period, as determined by the use of 2-hour incubations and 24-hour incubations in both the 1958-type fluorescent and sunlight incubators. Results of this analysis in counts per minute per hour are plotted vs. the time of first sample for both incubation periods and incubators on Figure 4.

Contrary to the experience of Vollenweider and Nauwerck (Verh. Internat. Verein. Limnol. XIV: 134-139, [1961]), these results do not show undue reduction of CO_2 uptake with incubations of 24-hour duration. It is interesting that incubations with the fluorescent light incubator which showed higher productivity than the sunlight incubator actually display less "bottle effect" than found for the sunlight incubator. Certainly, differences due to kind of source light are greater than those due to "bottle effect".

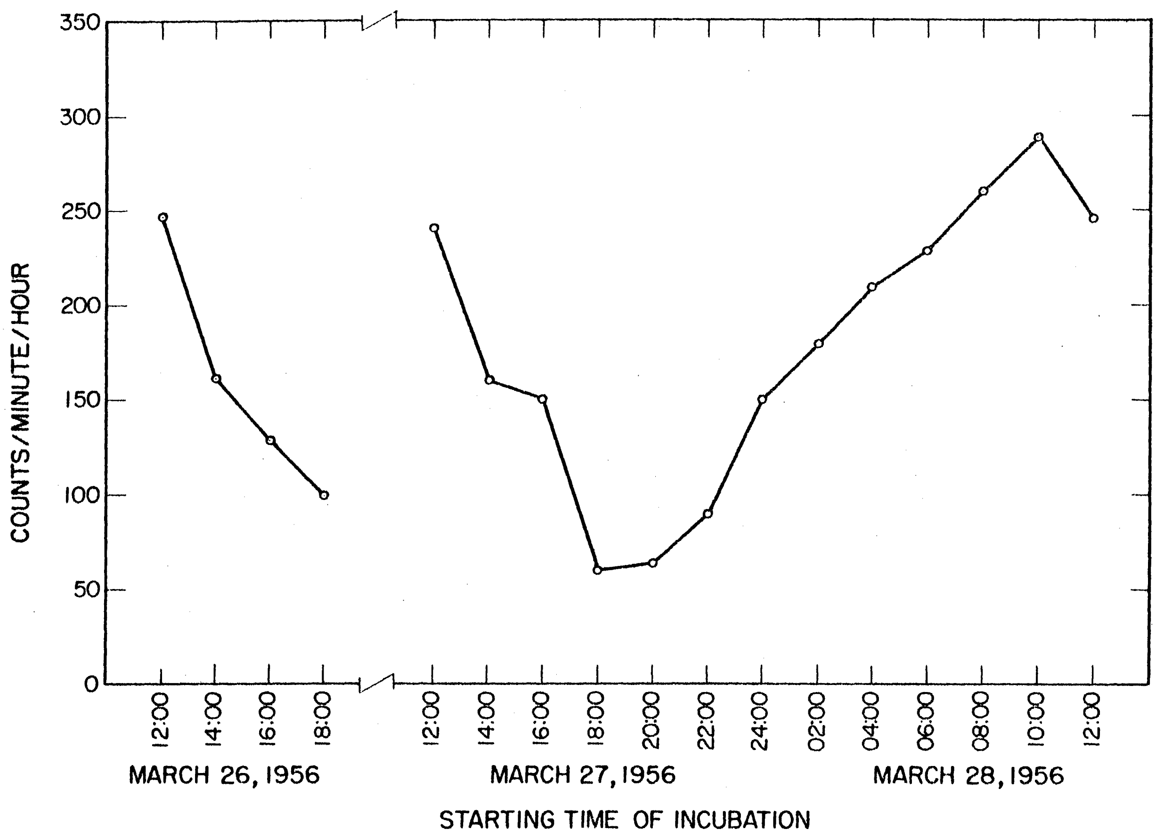

Figure 3. Carbon fixation rate as a function of incubation time in hours for subsamples taken from a carboy. Smith Cruise 33. NB21: 22-27.

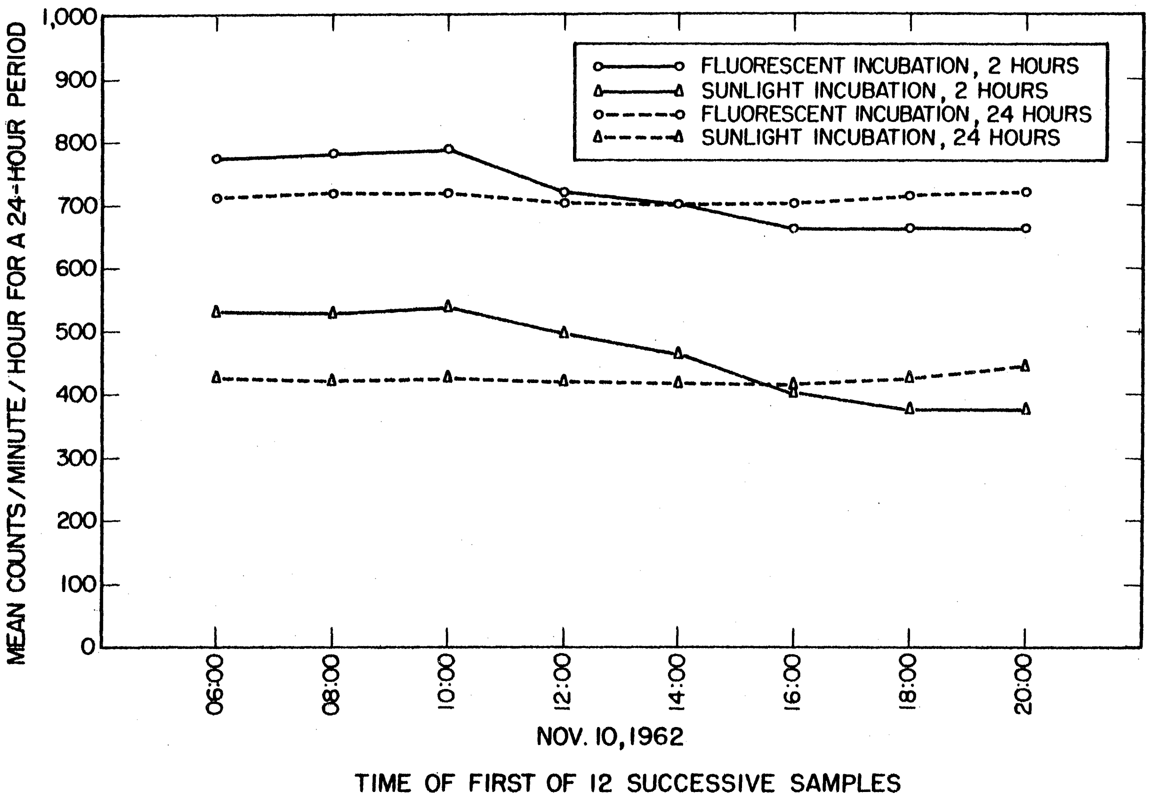

Figure 4. Mean counts per minute per hour for a 24 hour period with 12 hours of light and 12 hours of dark. Each value represents an average for 12 successive samples taken every 2 hours. NB63: 114. Experiment 8.

We would like to call attention to the comparison of the mean values arrived at by making 2-hour incubations over a period of 24 hours vs. the means of 24-hour incubations initiated over a 24 hour period with the sunlight incubator. The values (total counts per minute per hour) for the 2-hour incubations and the 24-hour incubations are measures of the productivity in aliquot subsamples, taken at the same time, but not subjected to identical light conditions. For example, the "06:00 2-hour" value of 12,748 counts/24 hours represents fixation for samples taken 06:00, 08:00, 10:00, 12:00, 14:00, 16:00, 18:00, 20:00, 22:00, 24:00, 02:00 and 04:00; incubated, in order from 06:00 on the 10th of November to 06:00 on the 11th of November. The "06:00 24-hour" value of 10,206 represents fixation for samples taken at the same times but spanning an incubation period from 06:00 on the 10th of November to 06:00 on the 12th of November.

We suspect that it is because of changing light conditions that the difference between 2-hour and 24-hour values is greater with the sunlight incubator than with the fluorescent incubator where light was held constant. Further support for this contention may be found in a comparison of 2-hour and 24-hour incubation values by sample time on the 11th of November (Figure 1). Note that the 24-hour values of the 11th compare favorably in magnitude with those of the 10th, whereas the 2-hour values of the 11th are markedly lower than those for the 10th in the sunlight incubator.

We recognize that the fluorescent 2-hour values also can be interpreted as there being a progressively smaller photosynthetic biomass present (11th of November) but here, the total fixation (as represented by counts/minute/24 hours) dropped from 18,620 to 15,902

(15%) while the 2-hour value for fluorescent incubation dropped from 12,748 to 9,050 (29%) - meaning that a change in the intensity of sunlight on the 11th compounded the decrease due to biomass alone either by reason of being limiting or of such intensity to be inhibiting.

On the basis of these findings, it may even be argued that any alleged loss of accuracy traceable to the "bottle effect" is more than compensated for by the tendency of 24-hour incubations to "wash out" short-term variations in the environment. Similar treatment has been given to the results of Experiments 7 and 9, these data shown respectively in Tables XXXVIII and XXXIX.

The next step in our exploration of the periodicity phenomenon was to undertake Experiment 9. This was designed to measure the hypothesized variations in biomass quality and/or quantity as well as the periodicity in potential of said biomass for radioactive CO_2 uptake.

Code	Treatment	Measure of variation in:
A	Samples taken every 2 hours and run immediately with 2-hour incubations.	Photosynthetic biomass and productivity index.
B	Samples taken every 2 hours and run immediately with 24-hour incubations.	Photosynthetic biomass.
C	Samples taken every 2 hours and held for inoculation and incubation till a standard (14:00-16:00) time of day.	Photosynthetic biomass.
D	Large sample taken once a day (@ 14:00) and subsamples drawn every 2 hours for immediate 2-hour incubation.	Productivity index.
E	Sample taken every 2 hours for filtration and dry weight.	Biomass.
F	Sample taken every 2 hours for chlorophyll analyses.	Chlorophyll.

It was expected that of the difference between the sets of results A, B, C, and D:

A - B would measure relative changes in the productivity index;

A - C would measure relative changes in the productivity index; and,

A - D would measure relative changes in the photosynthetic biomass.

A variation was expected of "E" vs. the time of day and related to productivity as determined by "B" and "C" directly... note Table XVII, Appendix I, Annual Report, 1961, data for high productivity samples taken on cruises K03, K04, K05, K08 and K09 (the current coding adds another "0" after the K; thus, K003, etc.).

Unfortunately, sufficient fluorescent light incubators were not available at this time to properly test the hypothesis and the three variables of:

a) Periodicity in the productivity index;

b) Changing photosynthetic biomass; and

c) Changing light conditions,

could not be properly separated with the sunlight incubator that was employed in Experiment 9. There are, however, several methods available for comparison of results from the different sampling, holding, and incubation techniques. Note that "B" and "C" are thought to be measures (it is accepted that they are only relative) of the photosynthetic biomass. Although the sunlight conditions were not the same each day between 14:00 and 16:00 and we do not have "correction factors" for this variable, there is a striking agreement between the results from the two techniques of incubation as shown in Figure 5. In our

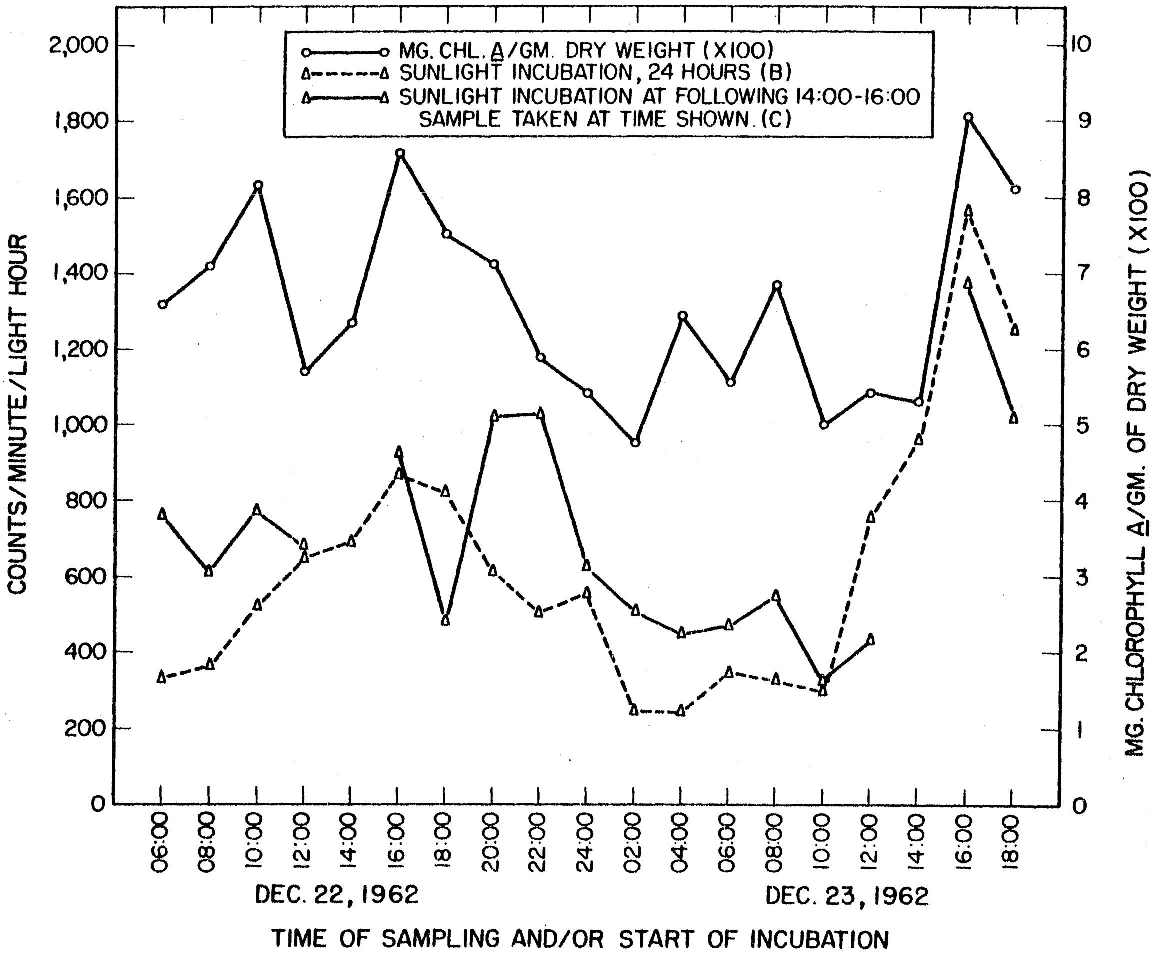

Figure 5. Comparison of three measures of photosynthetic biomass as they vary with sample time in hours. The photosynthetic rates from the two types of sunlight incubations being interpreted here as due largely to variations in biomass. NB71: 20. Experiment 9.

TABLE XXXVIII. Total counts/min./hr. for a 24 hour period as determined by the use of 2-hour incubations. Experiment 7. NB63: 70-89. September 12-13, 1962.

Start of 24 hour period	Sunlight incubator	1958-type fluorescent incubator
06:00	11,322	15,068
07:00	11,302	15,097
08:00	11,296	15,235
09:00	11,317	15,450
10:00	11,271	16,284
11:00	10,815	16,415
12:00	11,699	19,141
13:00	12,221	20,074
Mean per 24 hour period	11,405	16,596
Mean per hour	475	692

TABLE XXXIX. Total counts/min./hr. for a 24 hour period as determined by the use of both 2- and 24-hour incubations. Experiment 9. NB70: 80-117. December 21-24, 1962.

Start of 24 hour period	Sunlight incubator		1958-type fluorescent incubator
	2-hour incubation	24-hour incubation	2-hour incubation
06:00	5,158	6,404	10,456
08:00	5,094	6,418	10,892
10:00	5,556	6,382	10,986
12:00	5,514	6,160	10,750
14:00	5,346	6,268	10,440
16:00	4,946	6,544	10,544
18:00	5,288	7,234	11,970
20:00	5,288	7,664	11,970
Mean/24 hours	5,274	6,634	11,001
Mean/hour	220	276	458

opinion, this agreement is sufficient to lend support to the hypothesis that photo-synthetic biomass varies from one time of day to another and that this variation is either directly or indirectly related to light conditions over the 24 hour daily period. Recall that similar results with 24-hour incubations (B) were obtained in the November 1962 experiment (8) and that the several results from our September 1962 experiment (7) are also in line with this conclusion.

The results of our dry weight and chlorophyll a analyses are erratic. We do not have absolute faith in either our dry weight data (spillage of sample during filtering, etc.) or in the chlorophyll a data (use of a faulty spectrophotometer, etc.), but it is to be seen that variations of this "calculated photosynthetic biomass" are not contrary to the other two plots shown Figure 5.

On the other hand, the productivity index, Figure 6, of counts/ mg/m^3 of chlorophyll a is quite similar in cycle with that arrived at indirectly and shown in Figure 2 for Experiment 8. All indications are that within the Waikiki Natatorium population, the:

a) Productivity index reaches a maximum at 14:00 and a minimum at 20:00; and
b) Photosynthetic biomass is highest at 16:00 and lowest at 06:00.

Our most recent effort along these lines is Experiment 10. Analyses have not been completed but the results to date are included here for their interest and for the purpose of bringing all information together in one place as of this time.

Establishing a "standard time" for sampling has been a matter of particular concern which could now be viewed in light of the results of

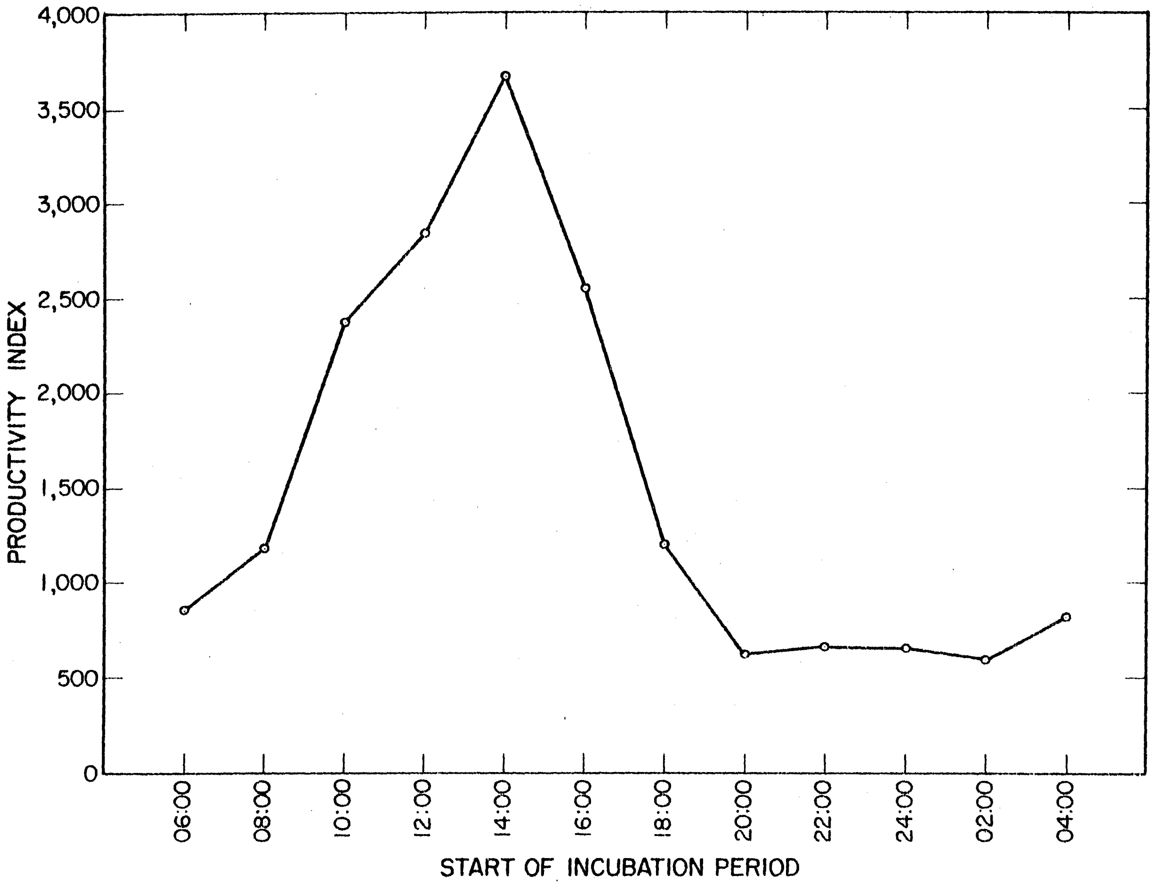

Figure 6. Productivity index as counts per minute per hour per mg per m^3 of chlorophyll a. Mean data for 06:00, December 22 to 04:00, December 24, 1962. NB71: 16. Experiment 9.

Experiments 7-9. We have evidence that this time is not best selected as 12:00 in spite of the fact that even 12:00 is recognized as leading to productivity values which are only relative to the absolute fixation _in vivo_. Our data (from the 30- and 60-hour experiments using the Waikiki Natatorium populations) indicate, without exception, that productivity measured by the carbon-14 method is very definitely related to the time of sampling. We also know, historically, from other recent experiments, and from these same natatorium experiments, that fixation is related to the incubation light source - perhaps both quantitatively and qualitatively. Although not _in situ_, our results from 12 successive samples taken every 2 hours, as described above, provide a weighted average for productivity which is certainly a better measure of organic carbon compound formation than that estimated from 12:00 incubation results. As expected, there are two times every 24 hours when individual 2-hour incubated samples give results approximate to this weighted average. A summary of these sample times (by interpolation) is shown, for the three Experiments 7-9, by incubator type in Table XL. We are convinced that samples taken at these times will give results more nearly related to actual productivity than will samples taken at 12:00.

TABLE XL

	Experiment 7		Experiment 8		Experiment 9	
Incubator	Fluorescent	Sunlight	Fluorescent	Sunlight	Fluorescent	Sunlight
Morning	07:50	08:05	08:05 07:20 07:20	08:05 08:05 07:35	07:00 06:30 08:10	06:25 06:20 06:55
Afternoon	18:45	16:55	18:30 17:45	17:00 17:00	18:45 18:35	17:25 17:30

Average =

	Fluorescent	Sunlight
Morning	07:34	07:21
Afternoon	18:20	17:02

2. Non-diurnal cycles

Experiments 2 through 5 were originally designed to determine relative fixation by sampling time and incubation period with several incubators having different light sources. However, these have also provided data which indicate variations from day to day in the magnitude of productivity which are of a non-diurnal nature. Figure 7 is a graph of the results (Tables II and IV) from Experiments 2 and 3.

Because of the rather regular increase or decrease in fixation over periods of several days for both 06:00 and 12:00 samples, we would think that this must be associated with manifestations of an outside physical or biologic influence such as phase of the moon, outflow of sewage or other wastes, *etc*.

Note that the low counts per minute per light hour were experienced on the 19th and the high counts per minute per light hour on the 23rd. It is interesting that both low tides of the 19th were at the same level on this day as were the two high tides of July 23rd.

Another observation is that from the 14th to 19th of July, a high tide immediately preceded the 06:00 collection and a low tide immediately preceded the 12:00 collection. From the 20th to 24th of July this situation was reversed, and from the 25th to 31st of July it reverted back to the 14-19 July situation. Thus, the first situation was extant during the decreases in counts per minute per hour 14-19 July and 25-30 July, while the latter was extant during the increase in counts per minute per hour for 20-24 July.

This cyclic change, which may or may not be a regular periodic

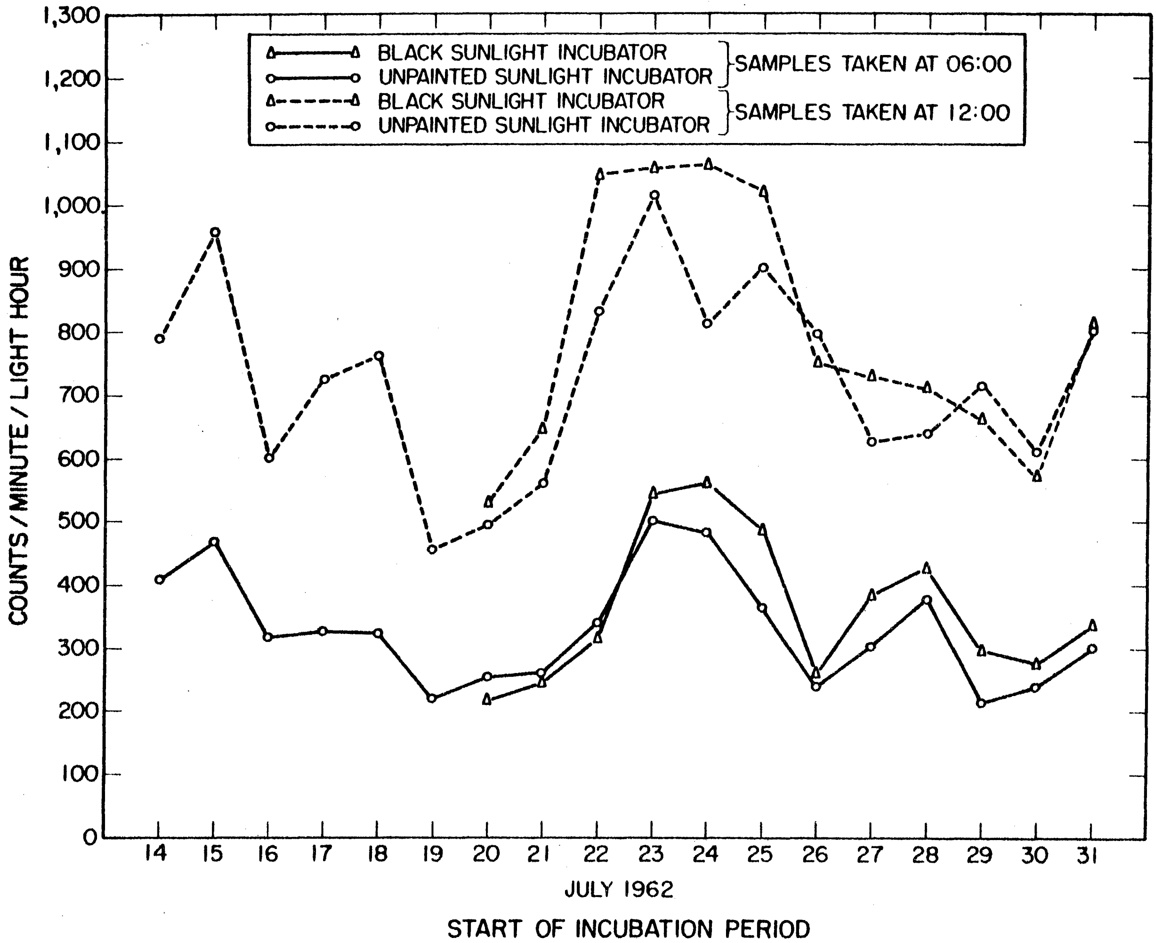

Figure 7. Mean light bottle counts per minute per light hour for incubations started at 06:00 and 12:00, plotted as a function of the day the measurements were made. NB68: 11-73. Experiments 2 and 3.

change related to lunar cycles and the tides, can be very large as shown in Figure 7 and particularly, in Table XLI, a summary of Experiments 4 and 5. It should be more thoroughly investigated over a period of at least one month with the expectation that cause-effect relationships can be more clearly drawn. This is of considerable ecological interest in relation to the food supply and survival of the fish and invertebrate larvae that are spawned in respect to lunar cycles.

Note that the "time of sampling" has a greater influence on the measured fixation than either the length of incubation or the light source (1958-type fluorescent and two different sunlight incubators) used for the experiments yielding the data for Figure 7 and Table XLI. It has subsequently been found (Doty, _et_. _al_., mss.) that the differences obtained in results from the techniques used for phytoplankton productivity in Australia, Japan, Russia and Hawaii are also less than the variations due to the time of day the measurements are made.

The two types of periodic change described above must be taken into consideration if the results from different techniques and different times of measurement are to be compared. This is assuming the suspected lunar rhythm is actually present. Certainly, seasonal differences have been recognized and must also be taken into account in any summary of data gathered at different times of year.

TABLE XLI. Mean light bottle counts per minute per light hour of incubation. The incubators used were the 1958-type fluorescent light and the unpainted galvanized sunlight incubators.
August 15-21, 1962. NB68: 76-103, NB70: 2-35.

Sample time	Light source	Counts per minute per light hour of incubation started on August:						
		15th	16th	17th	18th	19th	20th	21st
06:00	sunlight	395	365	353	478	229	161	151
	fluorescent	---	---	408	580	373	257	217
12:00	sunlight	1486	1403	1888	1231	1169	647	532
	fluorescent	---	---	3043	1550	1223	1150	743

3. Respiration studies

There is at least one alternative hypothesis to that set forth on page II-64 as an explanation for the periodicity in fixation found with samples held in 24-hour incubation. This is that incubations started earlier in the daylight period will start to lose carbon-14 (which has been organically incorporated) during the dark night period, whereas incubations started at night will be respiring carbon-12 only during the initial hours and experience less carbon-14 loss by respiration over the entire 24 hour period. It will be noted (Figure 1) that the range in fixation between incubations started at different times of day is of greater magnitude than can reasonably be explained by differences in respirational loss. We continue to feel that the most defensible hypothesis for cyclic variations in CO_2 fixation, found by sampling every 2 hours and holding samples in incubation for 24 hours, is that the photosynthetic biomass is also varying in a cyclic manner.

We have data which also tend to discount the hypothesis of "respirational loss". Referring to Table VIII, it will be seen that the mean of samples taken at 06:00 and incubated until 18:00 in the 1958-type fluorescent light incubator gave 604 counts per minute per hour. An aliquot of the same sample, held for 24 hours in the same incubator, but with lights turned off between 18:00 and 06:00 the next morning gave 182 counts per minute per hour. If we assume that this second 24-hour set had fixation equivalent to the first set at 18:00 and also assume only minor variations in the respirational rate in light and dark, assign the letter "R" to this respiration loss, and set up an equation, it will follow this form:

(12) (mean counts/minute/hour from 06:00-18:00) + 12 R =

(24) (mean counts/minute/hour from 06:00-06:00) + 24 R,

where each side of the equation equals gross CO_2 uptake. This then becomes:

R = (mean 06:00-18:00 counts/minute/hour) - 2 (mean 06:00-06:00 counts/minute/hour).

In this example R = 240 counts/minute/hour, representing 40% of the average rate of net CO_2 uptake during the light (06:00-18:00) period of the day. The per cent of gross is 28. In this same experiment we also have data from the sunlight incubator. Here **R** = 25% of net CO_2 uptake and 20% of gross. A summary of R values, as a per cent of mean hourly daylight fixation, from other experiments is included together with these in Table XLII.

We recognize that the loss due to respiration is not of the same C^{12}/C^{14} ratio as is uptake until the organisms have come to equilibrium in this regard and that our calculations do not take this into account. The average rate of respiration taken from Table XLII and calculated as a per cent of gross daylight fixation is 15% and we might guess that actual respiration is of about this order of magnitude.

TABLE XLII. Respirational loss in terms of counts/minute/hour as a per cent of net and gross CO_2 uptake during daylight hours.

Expt.	Incubator	Date	Loss due to respiration as a % of: Net CO_2 uptake	Gross CO_2 uptake
1	Unpainted galvanized sunlight	6/27/62	3	3
2	Unpainted galvanized sunlight	7/14	10	9
		7/15	20	16
		7/16	35	26
		7/17	64	39
		7/18	18	15
		7/19	26	21
		7/20	--	--
		7/21	17	15
		7/22	10	9
		7/23	16	13
		7/24	21	17
		7/25	8	7
		7/26	3	3
		7/27	36	26
		7/28	32	24
		7/29	7	7
		7/30	--	--
		7/31	--	--
3	Black galvanized sunlight	7/20	22	18
		7/21	--	--
		7/22	--	--
		7/23	18	15
		7/24	5	5
		7/25	1	1
		7/26	2	2
		7/27	31	24
		7/28	--	--
		7/29	20	17
		7/30	16	14
		7/31	--	--
6	1958-type fluorescent	9/12	40	28
6	Black galvanized sunlight	9/12	25	20

4. Dark bottle uptake of carbon-14

Various attitudes exist in reference to the use of dark bottles. Steemann-Nielsen, among others, is wont (1958) to omit them, saying they are always about 1-2% of the light bottle values. Jitts (1963) uses a dark bottle for each light bottle while we (Doty & Oguri, 1957) use one dark bottle for each two light bottles. Dr. Olga Koblentz-Mischke (personal communication) has expressed the feeling that dark bottle fixation is a function of the technique used. Some techniques regularly omit the dark bottle in phytoplankton productivity measurement while with others they are regularly included.

At this time it seems desirable that the significance of dark bottle fixation be reviewed in respect to that in the light bottles and in respect to the causes of variation that can be observed. In the work of this contract various experiments have been carried out from which data can be drawn and applied to the following three variables in regard to dark bottle fixation.

a) Type of incubator.

b) Length of incubation period.

c) Time of sampling.

a) Differences in incubator. Our only information available, that can be separated by type of incubator, is for the September 12-13th experiment (Experiment 7 of Part A above) where 2-hour incubations of dark bottles were started every hour in both the 1958-type fluorescent light and galvanized iron sunlight incubators. An analysis of these data resulted in the following:

$$\text{Mean of 31 counts in sunlight incubator} = 18.4$$

$$\text{Mean of 31 counts in fluorescent incubator} = \underline{17.8}$$

$$\bar{d} = 0.6$$

$$t = \frac{0.6}{1.4} = 0.43$$

We conclude from these results that the two incubators are alike in their effect on dark bottle fixation and further suspect that differences in temperature are not significant between the two incubators which are cooled with the same sea water bath (as this is the variable which might have and probably would have accounted for any difference in counts per minute per hour).

b) In Experiment 8, dark bottle counts were taken for bottles held for both 2- and 24-hour incubation periods. Without exception, those held for 2 hours gave a higher count per minute per hour than the subsamples held for 24 hours (Tables XII and XVI). This may well be due to rapid initial chemosynthetic adsorption and other dark phase phenomena with a leveling off of the rate of these activities soon after a short term adjustment period. If such rapid dark bottle fixation is initial only and then at a lower rate proportional thereafter to time, it may likely occur within, at least, the first 6 hours of incubation as, note, similar data in Experiment 1.

Results obtained with the <u>Sargassum</u> experiment (NB26: 107) support this observation that dark uptake is initially high and then is proportional to length of incubation at a slower rate (Table XLIV).

TABLE XLIV. Dark uptake of carbon-14 by Sargassum.
April 4, 1961. NB26: 107.

Hours incubated in dark with carbon-14	Counts/minute/mg carbon of sample as $C_6H_{12}O_6$			
	Hours of light exposure before dark incubation			
	0	1	2	4
1	4.09	2.15		
2	2.03		2.87	
3		1.86		
4	1.16			1.61
6			1.37	
7		1.36		
8	1.23			

c) In the Annual Report on this contract for 1958 (pages 43 & 44), it is reported that a statistical study of the carbon-14 uptake measured in 49 pairs of 08:00 and 20:00 dark bottles showed little probability for a periodicity. Strickland (1960/Bull.no.122) picked up this note. We have not been satisfied that a comparison of rates for just two times of day is sufficient to reveal or deny the existence of some periodicity.

Experiments 7, 8 and 9 have provided considerable data which could be analyzed for dark bottle periodicity. These are summarized in Table XLV by time of sampling. All are from 2-hour incubations. Figure 8 is a graphic representation of the dark bottle periodicity as shown in the last column of Table XLV.

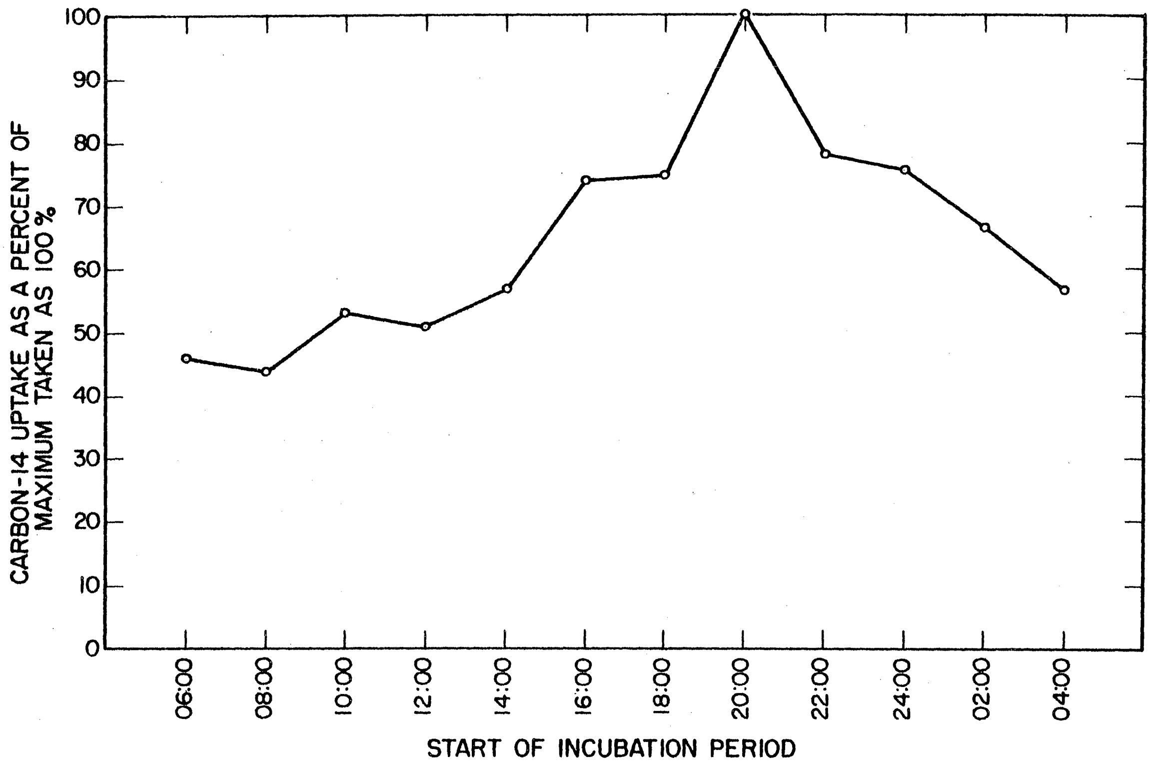

Figure 8. Periodicity of carbon-14 uptake rate in dark bottles as a function of the hour of day incubation was begun. NB71: 23. Mean data for Experiments 7, 8 and 9 (refer to Table XLV).

TABLE XLV. Dark bottle counts per minute per hour.
NB63: 70-89, NB70: 41-43, NB70: 80-117.

	Counts/minute/hour of incubation						
	Experiment 7		Experiment 8		Experiment 9		
	12-13 September 1962		10-11 Nov.	11-12 Nov.	22-23 Dec.	23-24 Dec.	
Sample time	Sunlight incubator	1958-type fluorescent incubator	1958-type fluorescent incubator		Plastic bucket		**
06:00	11	15	41	53	17	14	46
08:00	13	12	33	38	15	19	44
10:00	13	13	63	71	18	19	53
12:00	10	11	69	55	24	17	51
14:00	15	16	54	61	20	21	57
16:00	30	19	49	65	32	17	74
18:00	21	22	110	68	26	20	75
20:00	16	20	214	144	32	37	100
22:00	14	14	81	160	29	27	78
24:00	16	18	129	102	25	25	76
02:00	21	14	53	37	31	29	67
04:00	22	15	43	62	21	28*	57

* Only one light bottle.

** The figures in this column were calculated as follows:

a. The highest hourly count in each daily run was taken as 100% and all other data in the same run were taken as a per cent of this run.

b. An average per cent by sampling time was made for all 6 runs.

c. The highest of these was then taken as 100% and the other values, by time of sampling, were calculated as a per cent of this highest value.

Note on Figure 8 that fixation is least at 06-08:00 and greatest at 20:00. Perhaps it is only coincidence that dark bottle fixation is least at the time when biomass is also least (refer to Figures 1 and 5), but we tend to believe that there is a definite association---related to chemosynthetic phenomena of organisms which accompany (perhaps by adhesion) the photosynthetic organisms. It is also support for the hypothesis that the low chlorophyll content found in the natatorium surface water used, at this time of day, is due to less photosynthetic biomass and not due to a lower chlorophyll-biomass ratio. That chemosynthetic phenomena are, at least, partially responsible for dark bottle fixation is supported by the data shown below. NB26: 45-58, 67-71 outlines experiments and data with the use of streptomycin added to incubation bottles.

Six experiments in all are reported on with dark bottle results as shown in Table XLIII.

TABLE XLIII. The use of streptomycin as an additive to dark bottles. November 5-7, 1956. NB26: 45-58, 67-71.

	Counts per minute per hour of incubation						
Streptomycin in gamma/ml	Page 48	Page 50	Page 52	Page 54	Pages 68-69	Pages 70-71	Average
1.0	21	4	29	5	14	7	13
0.1	19	9	31	11	11	12	16
0.01	25	16	30	5	6	15	16
0.001	24	10	46	7	15	10	19
0.0001	19	9	34	7	11	9	15
0	19	28	38	5	38	7	23
0	18	18	42	12	14	14	20

The results (Table XLIII) of this experiment are inconclusive, but it could be more than chance that the bottles with the highest concentration of streptomycin had the lowest "dark" count and that the bottles without any streptomycin had the highest "dark" count.

Our conclusion is that either or both of the following obtained:

1. The added streptomycin was either not sufficient and/or specific to be completely effective against the chemosynthetic organisms.

2. It was completely effective (as 1.0 gamm/ml) and the remaining counts are due to dark phase CO_2 uptake and adhesion.

5. Carbon-14 uptake as a function of light source

Almost all shipboard incubator methods employ fluorescent light as the energy source to promote photosynthetic conversion of the inorganic carbon, including carbon-14, to the organic state. Since developing the technique for measuring this rate is the principal objective of this contract, a number of suggestions concerning light have been considered experimentally. The principal series of experiments has concerned the possible utilization of ambient daylight in place of fluorescent light. A long series of experiments (Experiments 11-16 of Part A) has made it clear that the "cool white" Westinghouse tubes and the 1500-foot candle light intensity used, in what is termed here the 1958-type incubator1/ yield higher results than do higher or similar sunlight intensities under what would otherwise seem to be the same conditions. In other experiments, these rates in one series of 4 were about 82% of those from "in situ" incubations carried out over the same period of time, and the comparable sunlight incubations provided values were 73% of the same "in situ" values.

1/ Both single- and double-ballasted 1961-type fluorescent incubators have been tested (Experiments 11-13). The essence of the 1961-type was its having a bank of 8 20-watt fluorescent tubes above the bottles which, set on their sides, were in a pan with sea surface temperature water just covering them and sufficient circulation that they were kept uniform in temperature. The double-ballasted incubators were so wired, for in the September 1961 SCOR intercalibration trials, it appeared that the light intensity of the single-ballasted incubators was too low to induce photosynthesis at 100% of the normal or pre-conditioned rates. A test of a single tube (double-ballasted) yielded light measurements about double the single-ballasted value while operating several hours before a whole incubator was wired.

The first experiment (Experiment 11) carried out to determine the comparison of rates of carbon-14 fixation indicated success in that the double-ballasted incubator yielded about 2 times the rate obtained with the single-ballasted lights. Therefore, a second experiment (Experiment 12) was done utilizing the same incubators and sets of

Figure 9 represents the average fixation for Experiments 13-16 with each of the 4 incubators represented when fixation is given relative to fixation at 100% light intensity in the 1958-type fluorescent incubator. All 3 sunlight incubators behave in the same general manner with regard to fixation as a response to neutral density filtration of light. All show increases in fixation with 64% light intensity over what they gave for 100% light intensity. It has been noted that in only 3 of the 25 cases, where a sunlight and 1958-type fluorescent incubator have been used for incubating aliquots of the same sample, has fixation with a filtered or unfiltered sunlight source ever equaled that in the artificial type. One would suspect that near optimum (or at least nearer optimum than 1958-type fluorescent, 100%) must have occurred more often on the 10 different days (6 July, 25 July, 15-22 August, 6 October) when one or more of the sunlight versions has been run beside the 1958-type fluorescent. A neutral density filter which cuts the intensity of inhibitory wave lengths to the level where they are no longer inhibitory could also be reducing other wave lengths to the degree that light is then limiting at that level of intensity.

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neutral density filters. This time the results were very different with the two electric incubators yielding about the same results. As a result, the light intensities in the bottle positions were measured. The values obtained indicated much lower values than those expected, a marked decrease during the 10 to 15 minute period during which the measurements were made and shortly thereafter, there was a failure of some tubes. However, no time measurements were recorded accurately.

To obtain useful measurement of the decay rate of the tubes when run double-ballasted, an illumination meter was mounted 50 cm from the center of a set of previously unused double-ballasted lights. The lights were turned on and the following record was made (5 July 1962). At about 19:21:30, a tube went out.

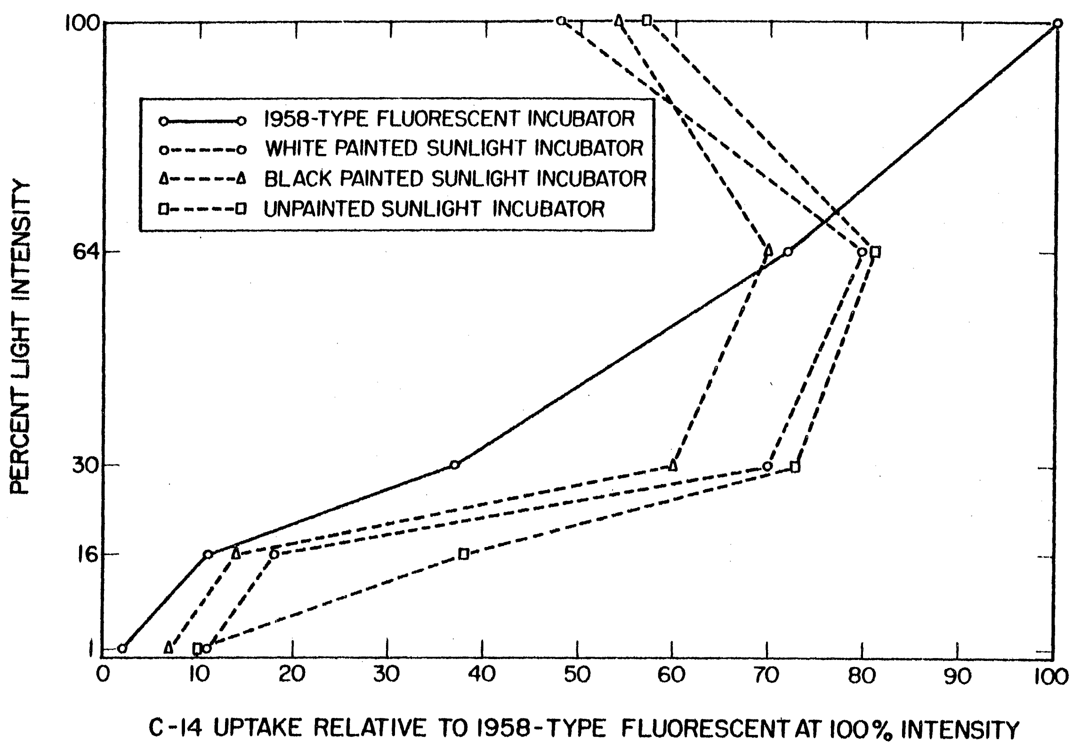

Figure 9. Carbon-14 uptake rate at 100% and at reduced light intensities, using sun and fluorescent light sources plotted as the per cent of the rate at the 100% intensity level in the 1958-type fluorescent incubator. NB's63: 32-34; 68: 28-33; 68: 43-47; 63: 90-97. Experiments 13, 14, 15 and 16.

This may possibly be the explanation for the observed phenomenon, as it has been noted that action and quite possibly "inhibitory" spectra are not the same for even different species of the same genus (Haxo & Blinks, 1950).

The finger points rather naturally to the presence in the sunlight of some factor that is absent in the fluorescent light or to the particular balance between wave lengths present in the fluorescent or sunlight. Several experiments were carried out with the light intensity at the red end of the spectrum enhanced (NB69: 65-89). The general conclusion seems inescapable that per gram calorie of energy as measured with a B2M solar battery inside a glass fitting, calibrated against a Weston 756 meter (NB59: 33-40), the addition of infra-red actually enhanced photosynthesis throughout the range of intensities being used. Therefore, it was concluded that it is probably not the red in the sunlight that induces the observed inhibition. This is in contrast to Steemann-Nielsen's statement (1957 ICES Symposium Papers published in 1958) that red light is active in depressing photosynthesis rates.

Time	f.c.
17:24	940
17:32	790
17:40	715
17:48	685
18:01	660
18:12	640
18:37	620
19:04	615
19:21	605
19:21:30	1 tube went out
19:22:30	540

This terminated the experiment, but one more measurement was made. Then the lights were turned off and four would not re-light. A considerable amount of black dust in the tubes seemed associated with the decay. The tube assembly got very hot. In fact, during the experimental use of the double-ballasted light source, the plastic cover became deformed. The results indicate that after an hour of use, samples in such an incubator may be exposed to only about 2/3 of the initial light intensity.

Vollenweider (ONR Technical Report ONRL:13-63) has continued his study of phytoplankton production in Lake Orta investigating the effect of ultraviolet light on a number of phytoplankters. He found that in most cases the addition of only a small quantity of ultraviolet, with a wave length near the visible being used, strongly reduces the photosynthetic activity. In many cases this reduction was up to 50 per cent. Although ultraviolet light would be strongly absorbed by both the glass surrounding the incubating specimens and by the water which surrounds and covers the sample bottles, it was thought that reduction might be due to this range of however low intensity. A preliminary experiment (Experiment 20) on this subject is recorded in NB72: 77-89 and although the results are inconclusive without replication, there was an increase of photosynthesis when ultraviolet was reduced by the use of mylar filters.

6. Acid Washing

This subject has been taken up earlier in the *Annual Report* for 1961, pages 3-7. Further experimental work (Experiments 17-19 of Part A) has borne out the conclusion "that 0.001 N to 0.1 N HCl rinses seemed to be about equal in their effect on light-incubated plankton". Mean counts per minute per hour for the results of these three experiments are:

HCl Normality	Counts per minute per hour
0.001	573
0.01	593
0.1	540
1.0	580
10.0	365

A washing solution of 1.0 N HCl is also adequate for the removal of adsorbed inorganic carbon-14, but 10.0 N HCl is apparently releasing some of the biologically fixed carbon-14. Fumes with up to 10 minutes treatment are not satisfactory for this purpose.

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APPENDIX III
(1964)

Phytoplankton Algal Primary Productivity Equipment

Devised and Adopted During the Terminal Contract Period

As used by the Botany Department

of the University of Hawaii for

Work done under contract AT-(04-3)-15 with the U. S. Atomic Energy Commission

The phytoplankton algal primary productivity equipment devised and adopted during the terminal contract period 1961-1964 included the following items:

A. Hydrophotometer Control Box

B. Hydrophotometer Mounting

C. Plastic Sampler

D. Fluorescent Incubator

E. "In situ" incubation buoy

Since many of these pieces of equipment have proven very practical in use, they are described here and examples of sources where they can be obtained are provided for those who may wish to purchase these items in ready-made form. There are no known restrictions on the construction or manufacture of any of these items insofar as the people concerned with this contract know.

A. Hawaii Modifications of the Clarke Marine Photometer. In adapting this standard hydrophotometer for routine use in determining the depths to which different per cents of the surface light penetrate, a Wheatstone bridge circuit has been applied advantageously. Having been told of several much more complicated circuitries which surely must be a barrier to the wider employment of this useful device, the modification in use (Figs. 1-4) at the University of Hawaii is described here. This device permits lowering of the overboard cell directly until any predetermined per cent depth required is reached. This depth is reached when the galvanometer needle (Fig. 2) reads zero with the potentiometer set at a precalibrated setting for the desired per cent depth.

Figure 1

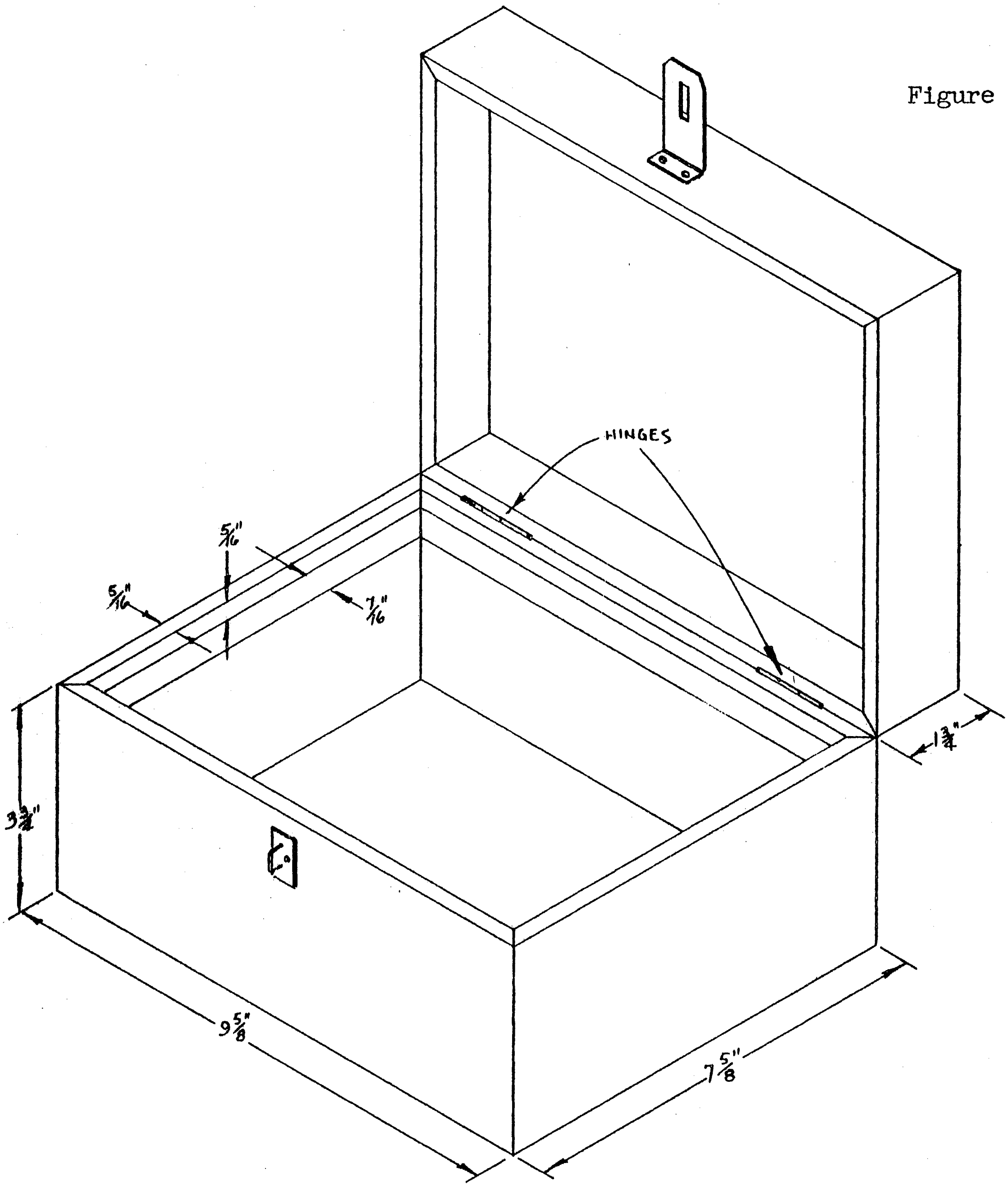


Figure 2

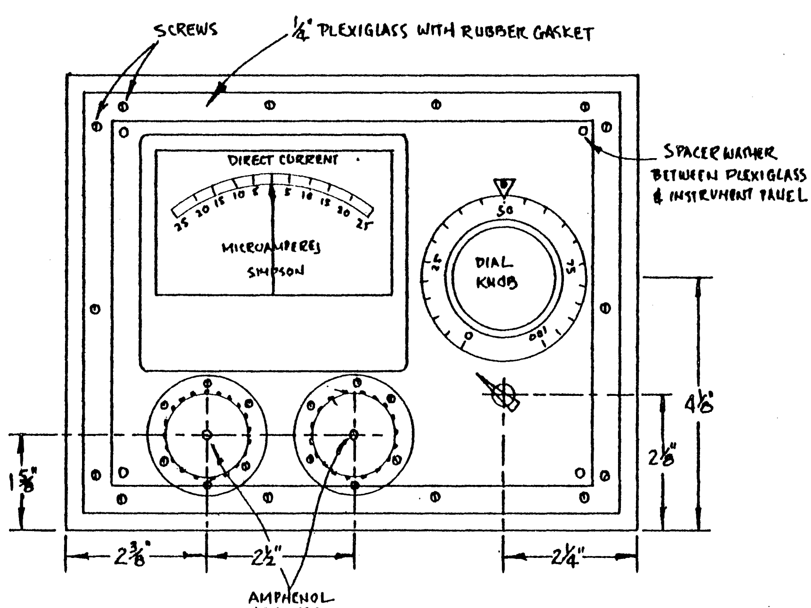


Figure 3

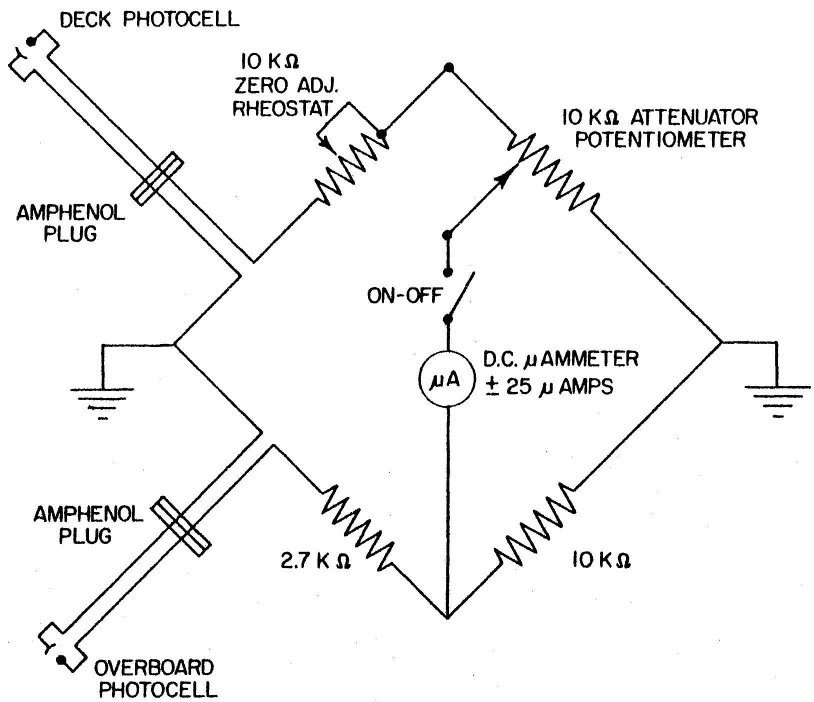
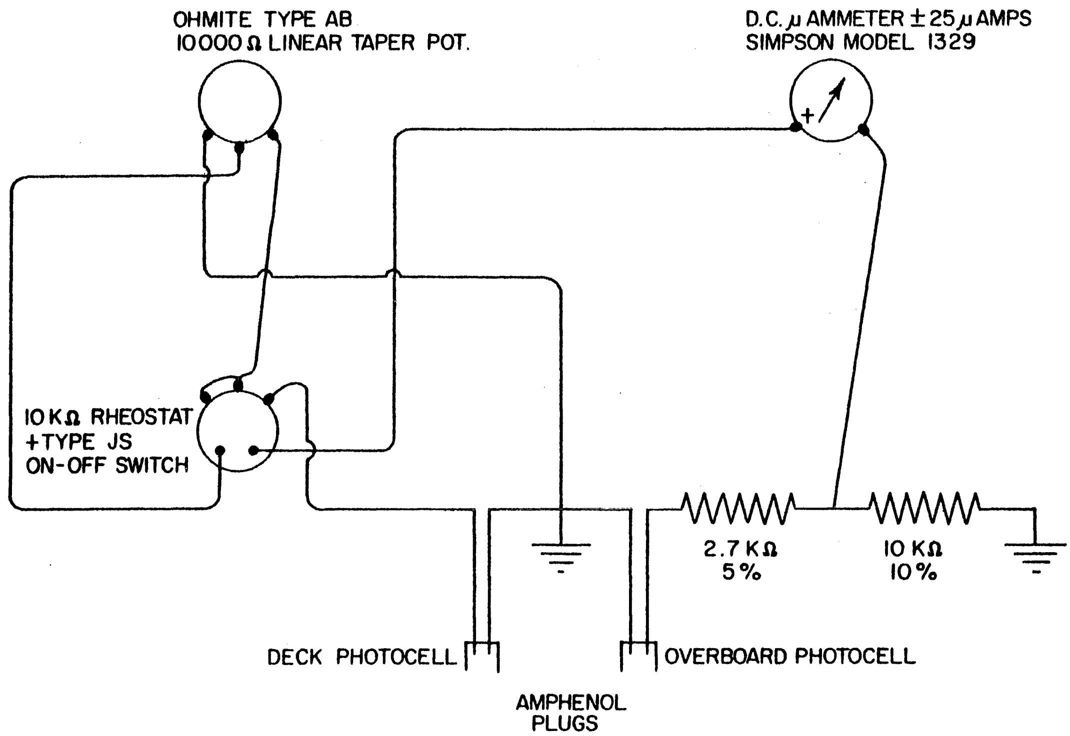


Figure 4



The constructional details given in Figures 1-4 should require, it seems, little descriptive prose. A list of the components is as follows:

1 Rheostat 10k Ω Zero Adj.

1 Rheostat 10k Ω + type JS on-off switch

1 Potentiometer 10k Ω Attenuator

1 Potentiometer, Ohmite type AB 10,000 Ω, linear taper

1 Ammeter, μ D.C. ± 25 μ Amps

1 Ammeter, μ D.C. ± 25 μ Amps, Simpson model 1329

2 Amphenol plugs #164-499

1 Resistor 2.7k Ω

1 Resistor 10k Ω

1 Resistor 2.7k Ω 5%

1 Resistor 10k Ω 10%

1 Box, watertight (Fig. 1), improvised to fit

Clarke Marine Photometers are supplied by Mr. Fred Scheuler (30 Albermarle Road, Waltham 54, Massachusetts, U. S. A.). The deck-cell is used as provided by Mr. Fred Scheuler. See below for overboard cell. Rubber covered 2-conductor wire to connect the overboard and deck-cells to the control box is obtainable in most large cities for 8 to 11 cents a foot. There is nothing peculiar about the Amphenol plugs, and other makes and models could be used just as well. Those used are secured in place by a screw-on or threaded collar, and when the wires are not attached to the box, the fittings are covered by caps screwed on in their place.

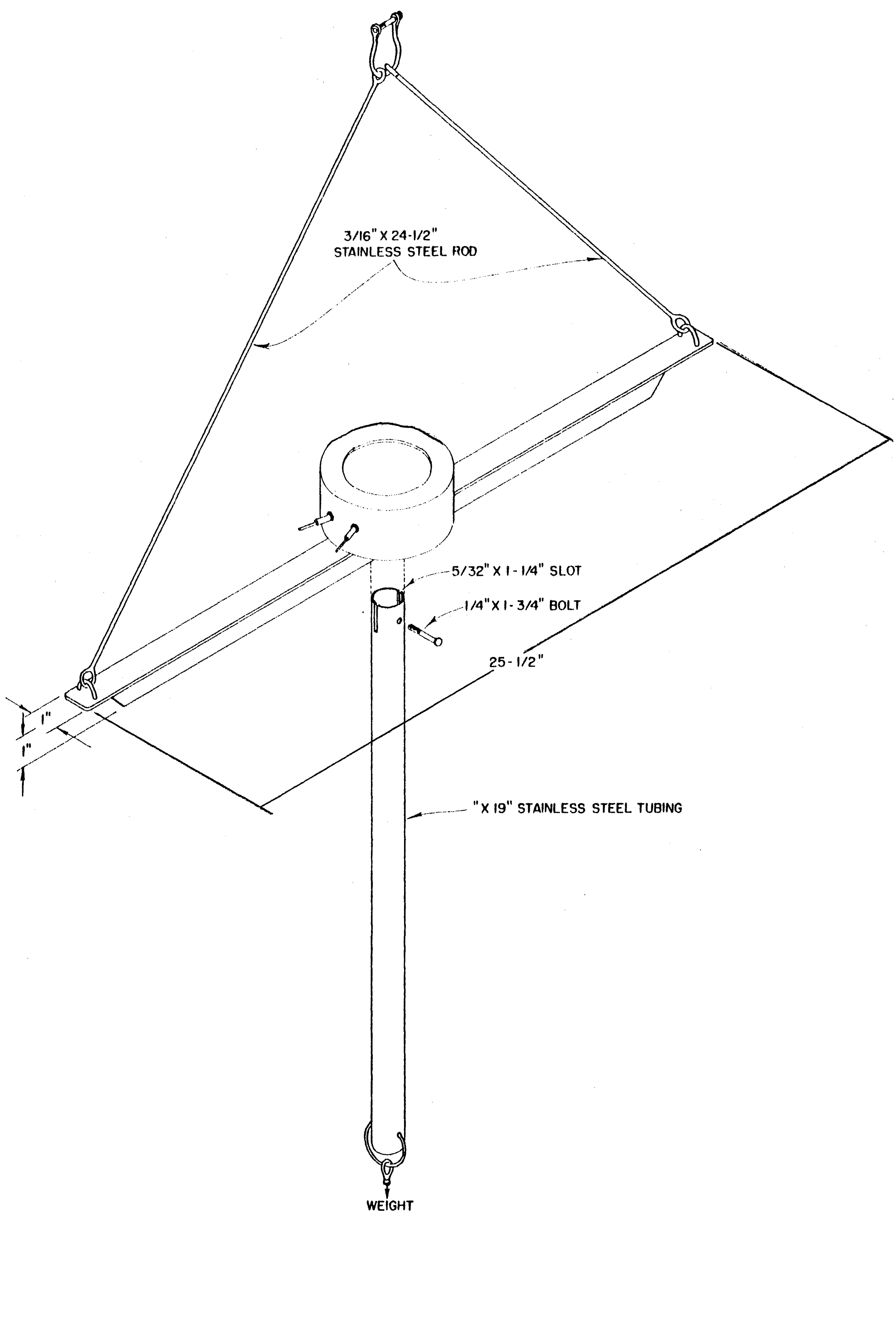
The control box described above can be purchased complete with the connectors from Lambert Electronic Service, 589-C Kawailoa Road, Kailua, Hawaii, U. S. A.

B. The overboard cell of the Clarke Marine Photometer is normally provided with a rigid frame which, while excellent mechanically, tilts with the wire angle and thus when the wire angle is significant, the flat plate irradiance collector is not horizontal. Especially if near the ship, the cell often faces the hull of the ship rather than the open sky. To avoid this and to obtain a suspension which can be collapsed for shipping, a suggestion made by Mr. Herbert Mann of the U. S. Bureau of Commercial Fisheries has been adopted leading to a new mounting. The mounting (Fig. 5) is of stainless steel and the overboard cell provided by Mr. Fred Schueler is mounted at the center of the horizontal T-bar as shown.

Since the eyed ends of the stainless steel rods are free to move, the weight keyed through stainless steel tubing to the T-bar keeps the cell horizontal though there is a significant wire angle.

Ideally, in use the overboard cell is lowered until just beneath the water. In rough weather it may be set in a tub so the receiver is just beneath the surface. The control box is turned on and with the "dial knob" set at 100, the galvanometer needle is brought to zero by turning the zeroing potentiometer knob which also activates the on-off switch. This zeroing provides per cent depths in terms of the amount of light getting into the water, i.e., it automatically subtracts for reflectance and surface film absorption. Some workers accept the value just beneath the surface as 92 per cent of the light reaching the surface, but with the method in use in Hawaii the amount of light getting into the surface water is taken as 100 per cent. In practice, however, in the data tables a 99 is recorded as the per cent value instead of 100 for only two columns are allowed for per cent depth in the data system used.

Figure 5



3/16" X 24-1/2"
STAINLESS STEEL ROD
5/32" X 1-1/4" SLOT
1/4" X 1-3/4" BOLT
25-1/2"
1"
1"
"X 19" STAINLESS STEEL TUBING
WEIGHT

The measurements are made from the lighted side of the ship.

The control box described here, being activated only by the output of the photocells, is only operable above the 0.1 per cent light level and towards evening or early in the morning is quite insensitive at the 1 per cent light level. This means that at the deeper levels it is hard to decide at just what depth the desired light level is located. A smoothly and rapidly running winch allows one to "tune-in" the depth by successive determination of midpoints between where the overboard cell is too far down or too far up. However, at the deeper levels the rolling of the ship and the passing of swells is less of a problem. At the shallower depths the rolling of the ship and the passing of swells combined with the greater sensitivity of the apparatus may cause some difficulty. These aspects of determining light per cent depth, especially near the surface, are not peculiar to this instrument but are merely problems general to the measuring of subsurface light from a ship at sea.

Calibration of the instrument is done in two ways. First, by measurement of light, for example, in a darkened long hallway, with the overboard cell at measured distances from the deck cell and both faced normal to a light source. With this type of calibration, absolute measurements of the light are made at the same time with a Weston model 756 illumination meter. The second method is by covering the overboard cell with the different filters to be used and recording the "dial knob" (Fig. 2) setting that returns the galvanometer needle to zero. This latter is actually the method most often used by the University of Hawaii group. As a result of the calibration activities, Tables are constructed for the different control box - cell pair combinations. The calibration does not seem to change significantly over long periods of time. An example of the "dial knob" settings for one set of per cent depths for one instrument combination is given in the following table:

Control box dial knob setting	Accepted light per cent depth	Layers of filter material*/
100	100 (99)	0
88	66	1
82	47	2
68	32	3
51	16	5
32	6	8
14	1	11

*/ The filters, in this case, are cylinders made of layers of black nylon netting.

C. A twin 6-liter plastic sampler (Fig. 6) that keeps the samples in the dark is in use. It is entirely of relatively non-toxic plastic and rubber, holds 6 or 12 liters of water, and is mechanically easy to use. This sampler, a result of the discussions of the SCOR sponsored intercalibration sessions concerning the productivity work for the International Indian Ocean Expeditions, was devised under the direction of Mr. Harry Jitts and is constructed in the shops of the CSIRO, Cronulla, New South Wales. A very similar sampler is constructed by the Rigosha Company (2, Kajicho 1-chome, Kanda, Chiyoda-ku, Tokyo, Japan) and comes in various models of differing capacity, some of which hold more water. A similar sampler is produced by Logan Smith and Associates (1300 West 253rd St., Harbor City, California).

D. The fluorescent lit incubator devised and used very widely (Figs. 7-9) is, with slight modification, produced by several commercial companies. Gemware Manufacturing Company (12 East 12th St., New York City) being one. The Rigosha Company mentioned above, is another. In

Figure 6

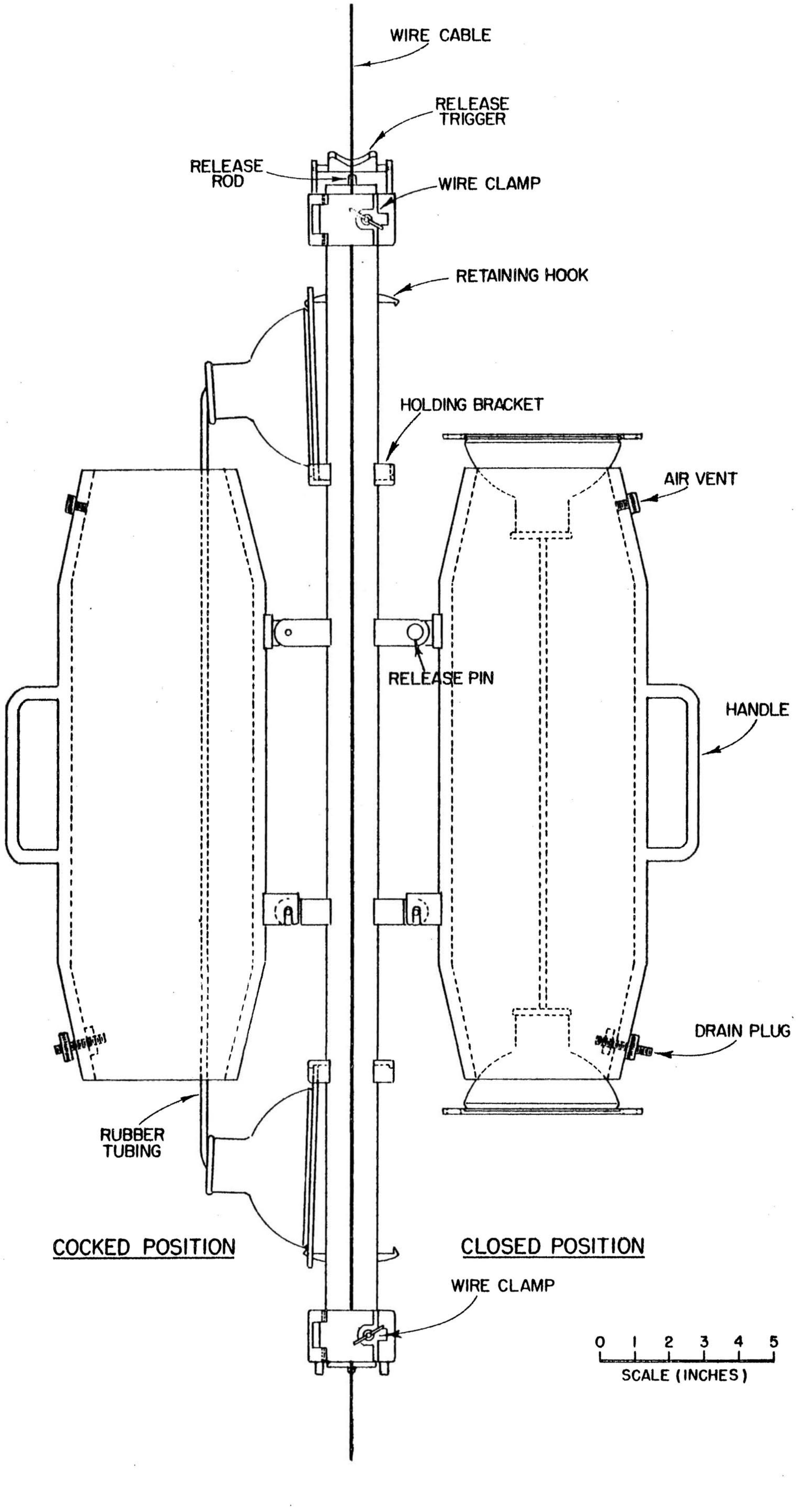

WIRE CABLE
RELEASE TRIGGER
RELEASE ROD
WIRE CLAMP
RETAINING HOOK
HOLDING BRACKET
AIR VENT
RELEASE PIN
HANDLE
DRAIN PLUG
RUBBER TUBING
COCKED POSITION
CLOSED POSITION
WIRE CLAMP
0 1 2 3 4 5
SCALE (INCHES)

Figure 7

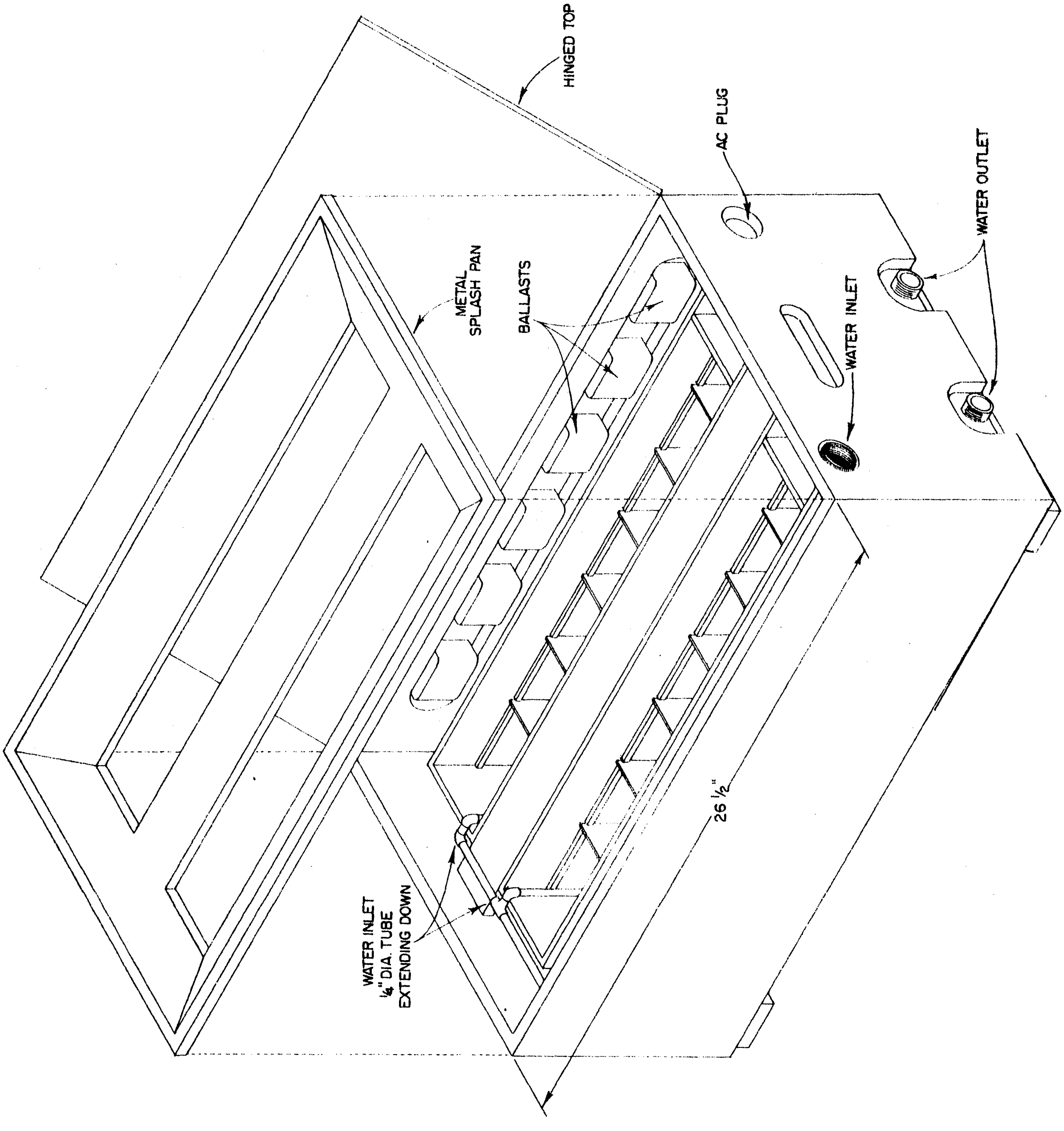

HINGED TOP
AC PLUG
WATER OUTLET
METAL SPLASH PAN
BALLASTS
WATER INLET
WATER INLET
1/4" DIA. TUBE
EXTENDING DOWN
26 1/2"

Figure 8

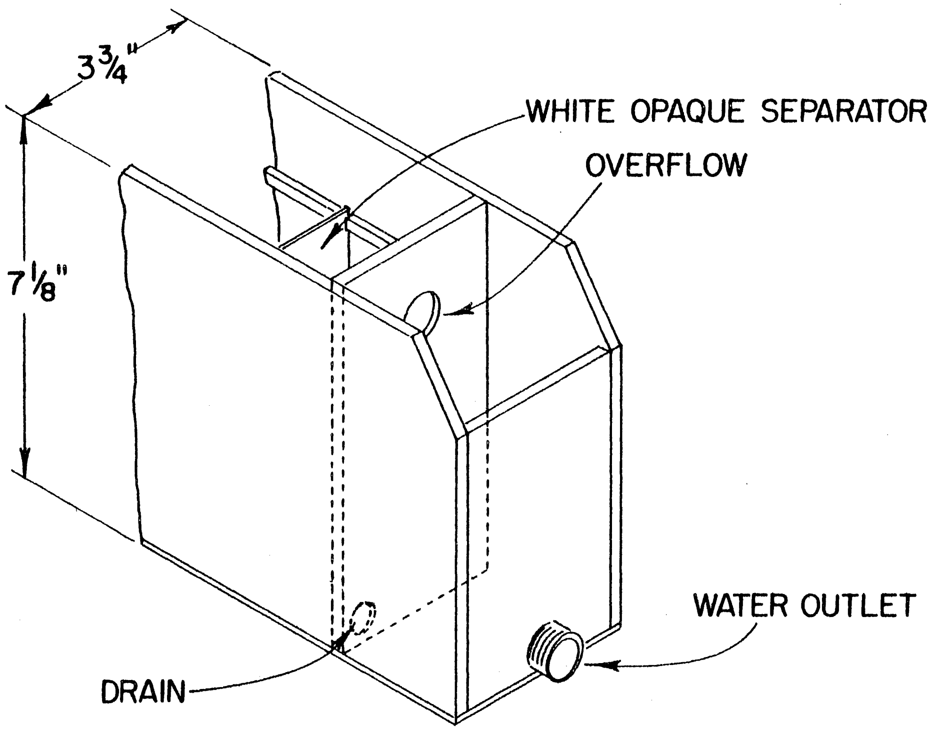
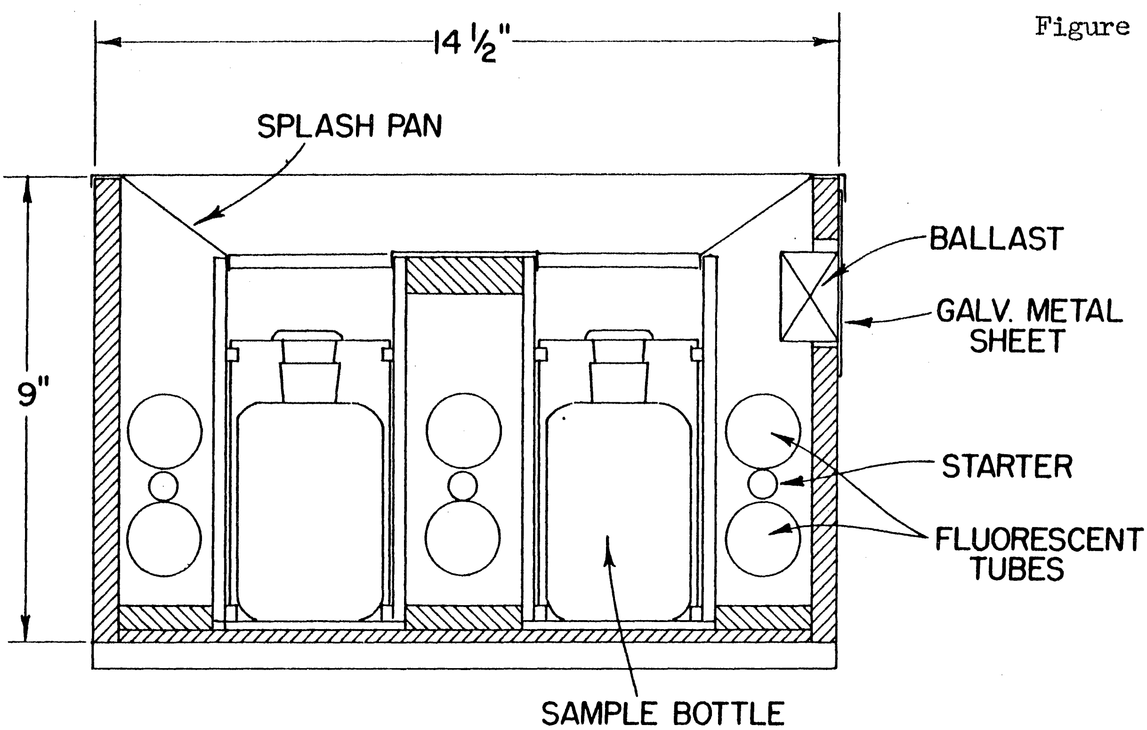


Figure 9



routine practice, only "cool white" Westinghouse tubes are used and with 110 volt (ca. 70 volts on each operating tube) current at 60 cycles. This yields about 1500 foot candles of light when the readings from a flat place collector faced normal to the light path faced toward the outside and then toward the center of any of the central five bottle chambers on either side are combined.

A good many features of this incubator type do not show in the simple illustrations (Figs. 7-9) provided here. Cooling is effected by water circulations around the edges of the white opaque separators shown on Fig. 8. The water is conducted in from the water inlet, a standard American hose female fitting, to the bottom at the rear of each tank through soldered $\frac{1}{4}$" copper tubing. The electric inlet AC plug is so tilted that the wire comes up to the plug and thus water running down the wire drips off rather than running into the plug. The ballasts (Fig. 9) are mounted on a galvanized iron sheet as a heat dissipating mechanism. The drain (Fig. 8) is closed by a cork from the inside when the incubator is in use.

E. A special "in situ" incubation buoy, or float, for suspending plankton samples in the sea for measurement of carbon-14 uptake during "in situ" incubations has been put into use. This float (Fig. 10) is constructed of two stainless steel surplus oxygen tanks and other stainless stock welded together. This model holds the bottles in place without extra tying as a spring (shown in Fig. 11) holds a short tube over the stoppered end of each bottle and holds each in its ring of plastic in such a way that they cannot come out even though there is considerable mechanical action in getting the "in situ" string into or out of the water. The eye to which the line holding the subsurface bottles is tied

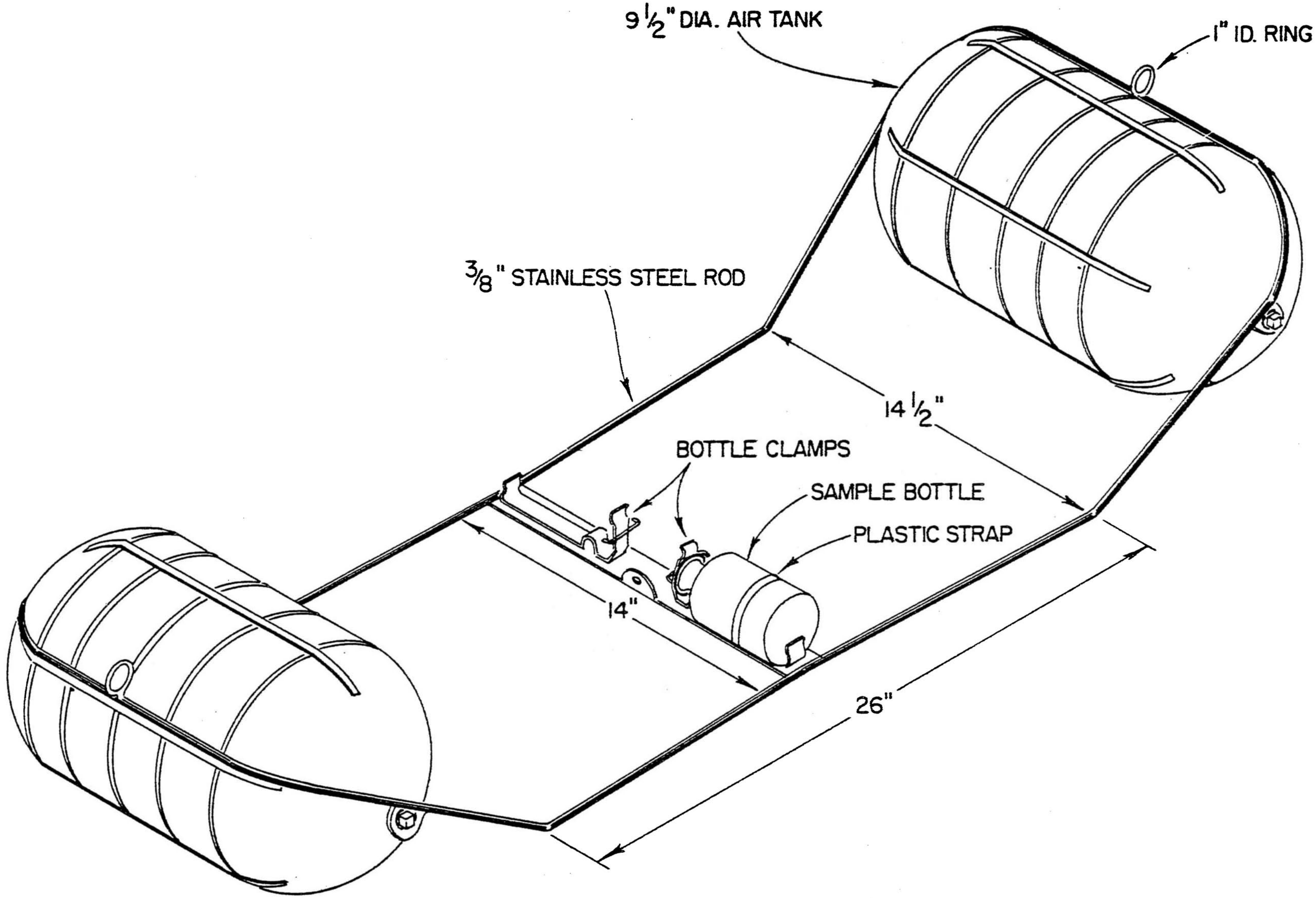
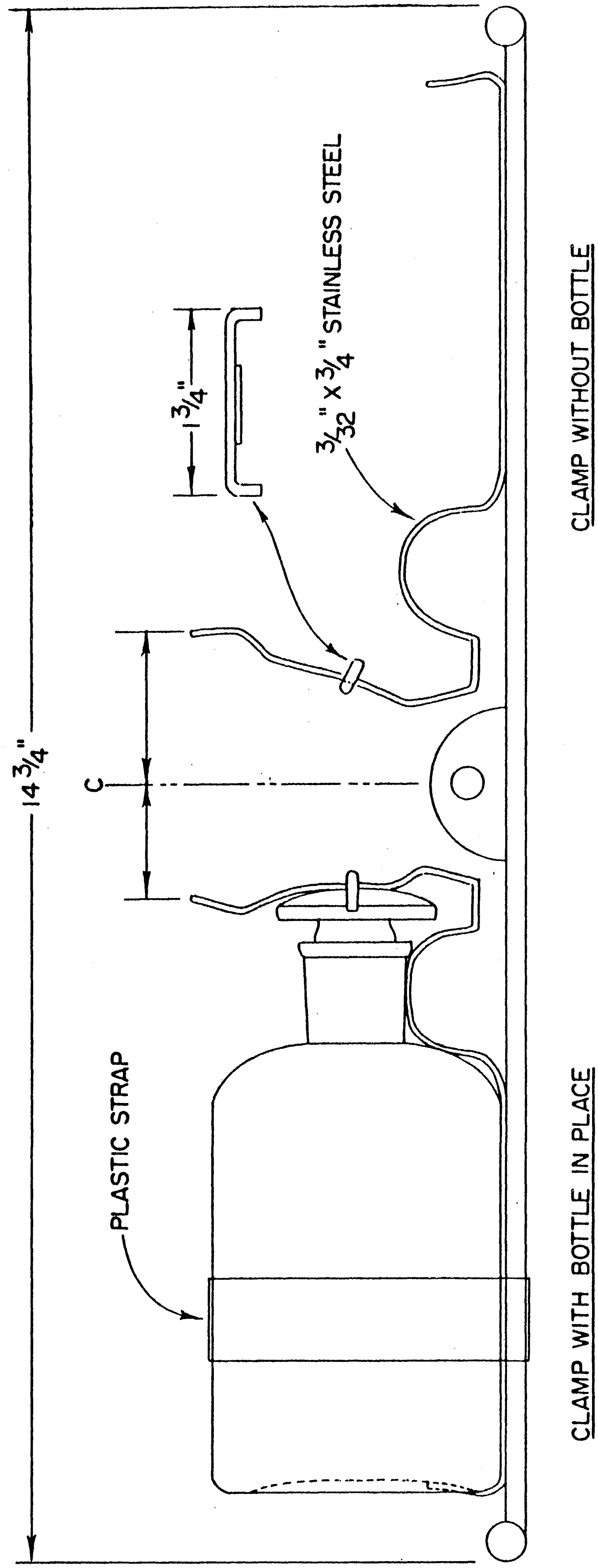

9 1/2" DIA. AIR TANK
1" ID. RING
3/8" STAINLESS STEEL ROD
14 1/2"
BOTTLE CLAMPS
SAMPLE BOTTLE
PLASTIC STRAP
14"
26"

Figure 10

Figure 11



CLAMP WITHOUT BOTTLE
CLAMP WITH BOTTLE IN PLACE
3/32" x 3/4" STAINLESS STEEL
1 3/4"
14 3/4"
C
PLASTIC STRAP

flips up so that the assembly is stable either side up when the float is laid on deck. The surface bottles fastened on this "in situ" buoy are held just beneath the sea surface. With thought being given to tethering the float from the ship, there need be no shading at any time of day. The tethering line used is strong enough to permit its use for hoisting the buoy and string of bottles aboard or lowering them into the sea.

A second modification has involved use of removable opaque covers over the bottles and bottle holders for "in situ" incubations. These covers are of black cloth and are wrapped around the bottles and kept over them while the bottle holders are fastened on the line from which they are suspended in the sea. The black cloth is pulled off a given set of bottles and retrieved by an attached light line as the bottles are lowered below the water surface.

The line to which the "in situ" bottles are attached is braided nylon with a weight attached at the bottom. This is much more convenient and easy to handle than the conventional hydrographic wire. The clamp assembly for holding the bottles below the surface is modified from a design (Jitts, 1963, Plate 2, Fig. 2) used by the CSIRO.

Literature Cited

Jitts, H. R. 1963. The simulated *in situ* measurement of oceanic primary production. Aust. Jour. Marine and Freshwater Research, 14: 139-147.